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THE METAL INDUSTRY

WITH WHICH ARE INCORPORATED
THE ALUMINUM WORLD: COPPER AND BRASS: THE BRASS FOUNDER AND FINISHER:
ELECTRO-PLATERS REVIEW.

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THE RECOVERY OF WHITE METALS FROM DROSSES

AN ARTICLE DEALING WITH IMPORTANT SMELTING AND REFINING PROBLEMS.

BY ADOLPH BREGMAN.

[This article is a sequel to the one The Manufacture of Soft Solders from Scrap Metals by the same author which appeared in THE METAL INDUSTRY for February. The present article deals more with the metallurgical reactions of the whole field of white metals rather than with manufacturing details of one particular class.—Ed.]

SORTING.

In smelting white metal drosses the first thing to be careful about is not to mix the different kinds, which are as follows:

1. Solder dross—lead and tin.
2. Tin dross.
3. Lead dross.
4. Hard dross—lead, antimony and tin.
5. Babbitt dross—lead, antimony, tin and copper.

As a rule, these drosses can be told apart by the experienced eye, but not always. Any description would be useless because nothing but practice could enable one to distinguish them. The furnace in which they are smelted is the simplest reverberatory type. It can be either coal, gas or oil fired.

In opening the subject of furnaces one is immediately swamped by the magnitude of the field and the mass of material to be handled. I shall try therefore to avoid any involved technical discussion, such as comparative formulae, etc. The manufacturers, like the Monarch, Rockwell or Quigley companies are best fitted to handle topics of that type. The one underlying principle of the reverberatory furnace, however, is that the heat is deflected from the fire box to the charge by means of an arched and curved roof. After the heat passes the charge it goes up the stack; it is not applied through the charge but down onto it. This, of course, does not take advantage of all the heat generated, as a blast furnace does, but, on the other hand it does not lose any material in the form of flue dust.

SMELTING.

1. Blowing in.

Fire up the furnace to as high a heat as can be obtained. Open the rear charging door. (On some furnaces the door is made of iron and can be raised or lowered by a lever, on others it is simply an open hole which is filled up with bricks and damp fine coal.) Shovel in the charge and let it smelt for about an hour or two. During this time the furnace man should watch the charge carefully and keep his fire at top heat. When the top of the charge is melted and the charge is levelled off it must be stirred with the hoe thoroughly and then the furnace closed up again.

A charge that was actually used is as follows:

TYPE OF DROSS	PER CENT. OF METAL	WT.
1. Antimony-lead (clean)	75	2,000 pounds
2. Residue from sweating........	50	1,000 "
3. Miscellaneous, mixed oxide and clean metal dross	60	3,000 "
Fluxes: (1) $NaHSO_4$		20 pounds
(2) Scrap iron		25 "
Coal dust—None.		

The high percentage of metal in the dross is responsible for the small amount of fluxes used.

As for figuring the coal dust, the practical difficulties in the way of accuracy are very great. Complete analyses of the drosses and coal are necessary, and then the reactions, or rather the extent of the reactions within the furnace simply have to be guessed at. Information about the internal workings of the soft metal reverberatory is as yet very, very scarce. As a rule, however, coal is used sparingly, on account of the expense. I have never seen more than 100 pounds used to a 5,000-pound charge.

2. Tap.

Drive out the tapping bar and allow the molten material to run into the kettle (which has been warmed up to receive the metal) below the spout. As quickly as possible take one of the running bars (two of which have been put in the furnace to heat until the ends are red to white heat) and push it through the running metal into the tap hole. Twist the bar around in such a way as to melt the slag or metal in the tap hole that is frozen. As the bar cools it is necessary to pull it out again and continue reaming out the hole with the other hot bar. Care should be taken not to allow the bar to stick in the hole, as it will be very hard to remove. When all the metals and slag are drained from the furnace drive the tapping bar back far enough so that on the next withdrawal the materials will run out with perfect freedom. Open the charging door again and if there is any material left in the furnace it must be raked out through the door. Then shovel in the charge and close up the door again.

The material in the kettle is made up of metal, matte and slag in the positions shown in the accompanying sketch, Fig. 2. The metal is cast and stored for further refining. The matte and slag can be shipped as they also contain large amounts of metal.

The time taken for smelting a charge is, of course, variable, depending upon the local conditions. In one instance, however, a soft coal fired furnace which held about five thousand pounds of dross averaged about four hours to the charge. The other operations were as follows:

Tapping...............15 to 45 minutes.
Charging..............20 to 30 "

Other types of furnaces may take more or less time. The oil and gas burning types take somewhat less, but require a forced draft.

The disposition of the products can best be shown by the flow sheet, Fig. 3.

The treatment of the matte and slag, which is not in the domain of this article, but comes under brass and copper refining, can be explained in a general way. The blast oxidizes the sulfur to SO_2 and the iron is slagged cleanly. The copper and lead form an alloy and can be used for babbitt or resmelted to separate the metals.

SWEATING.

Charge the rough pigs of metal into a furnace which has been fired up to a lower heat than for smelting (but enough to melt lead). The tap hole is left open, and the charge door, instead of being closed tightly is simply covered with a piece of sheet iron. Soon the melted metal trickles out through the tap hole and into the kettle ready to cast into pigs. The remainder, which is composed of oxides, brass, copper, slag, matte, etc., is raked out and

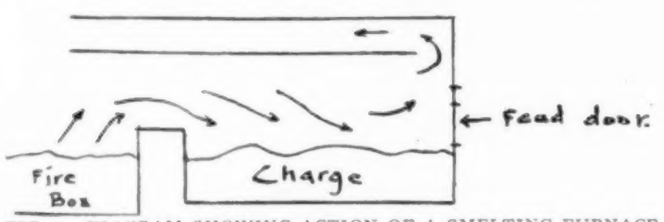


FIG. 1. DIAGRAM SHOWING ACTION OF A SMELTING FURNACE.

re-smelted with other dross. The clean metal is ready for use in making solder, babbitt or type metal as the case may be.

DIFFICULTIES AND METHODS OF OVERCOMING THEM.

1. Mechanical.

Firing.—This is like firing on any furnace of any kind. It must be done to be understood thoroughly. It is just as useless to go into detail about this as it would be to attempt to give a correspondence course in swimming. Experience is the only thing that can help.

"Clinkering" or cleaning the furnace.—This is the one great disadvantage of the coal fired furnace. It has to be shut down for cleaning the fire box, as often as twice a

FIG. 2. SHOWING HOW THE SMELTED PRODUCTS ARRANGE THEMSELVES.

week. The better the quality of coal, the less often it will be necessary to clinker, but at best it is a great disadvantage and loss. In this way the oil or gas furnace is far superior.

Burned-out sole.—Often, due to refractory drosses the sole of the furnace becomes lumpy with unsmelted material and interferes with the flow of metal through the tap-hole. A few shovelfuls of salt cake (Na_2So_4), directly on the rough spot will generally remove it, unless the surface of the bricks has become corroded, or burned. Then the furnace needs re-bricking.

Tapping.—Just before tapping drive the bar into the furnace a few inches. Then drive it out. The driving in has the effect of loosening it in the hole just a little so that it will drive out much more easily. When preparing to tap, heat two running bars to use in reaming out the hole after the tapping bar has been withdrawn.

When the tapping bar has been driven out, it sometimes happens that nothing will come out of the furnace. This is because the bar was not driven in far enough after the previous tap. A one inch bar must be driven deep into the furnace, as quickly as possible. This, when withdrawn will leave enough of a hole for the metal to run through, and the hot running bar will widen it out to its proper proportions. After all the metal is drawn off, great care must be taken that the tapping bar should be driven so far into the furnace as to make the next tap doubly sure.

4. If part of the charge refuses to run out, it is due to any (or all) of three reasons.

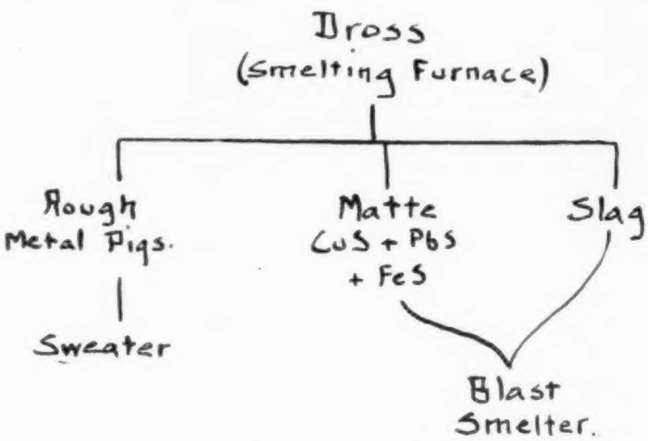


FIG. 3. FLOW SHEET OF A REFINERY.

1. Insufficient time allowed for smelting.
2. Furnace sole is in bad shape.
3. The charge is very refractory.

The residue must be raked out through the back of the furnace and smelted over. In the third case (the first and second were discussed previously), the trouble is due to the presence of too much copper (electrotype shells, etc., which are often mixed in the dross), or too thick and gummy a slag. The copper must be removed and saved for shipment or re-smelting in a different furnace. The thickness of the slag, however, is caused by the excess of silica in the dross. This can be remedied in several ways among which are:

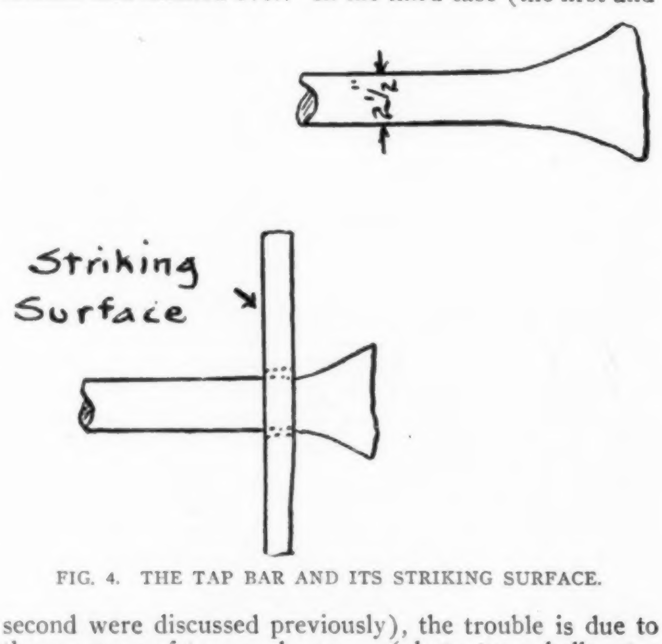


FIG. 4. THE TAP BAR AND ITS STRIKING SURFACE.

(a) Addition of $NaHSO_4$ to the charge. The reaction is as follows (taking magnesium silicate as an example).

$$NaHSO_4 + MgSiO_3 = NaHSiO_3 + MgSO_4$$

Both the sodium silicate and the magnesium sulphate are slagged without any difficulty. This, in general, explains the action of sodium sulphate as a flux.

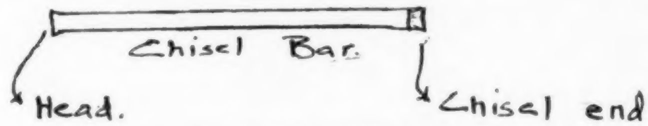


FIG. 5. THE CHISEL BAR.

(b) The addition of scrap iron in the form of old barrel hoops, etc. The reaction:

$$2Fe + 3SiO_2 = Fe_2SiO_3$$

The iron silicate is very quickly and easily slagged. These reactions do not give in detail all the chemical changes that go on inside the furnace. There are numbers which must remain unknown until more research work has been done. In a rough way, however, the main reactions are indicated above.

FLUXES..

Which flux to use and how much must be determined by the particular case in point. Salt cake is more expensive, but, on the other hand, it is less injurious to the furnace lining in most cases than iron. Often both are used. Also in many cases no flux at all is needed.

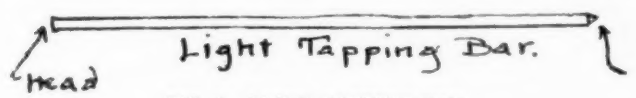


FIG. 6. LIGHT TAPPING BAR.

5. If it is found that too much oxide is left in the furnace after the tap, the trouble can be remedied by adding a few shovelfuls of fine coal (preferably anthracite but soft coal will do). The reaction is simple.

$$C + 2PbO = CO_2 + 2Pb$$

Carbon dioxide, which is a gas, escapes through the stack.

6. When replacing the tapping bar after the tap, keep it pointed as low as possible, in order to get all the metal that is possible, out of the furnace.

FIG. 7. THE RABBLING HOE.

7. One of the most remarkable qualities of the reverberatory dross furnace is its ability to stand up and continue working when it seems to be falling apart. I have seen a furnace with the sole half gone, with the side walls partly eaten out, with the bridge almost toppling, and with numerous spaces between the bricks in the arch, and still it ran! To be sure its work was not up to standard, but at that time it paid better to run it as it was than to tear it down and build another. Then after a shut-down, it was patched up with fire clay and a few bricks, and was run as a sweating furnace for a month. The only deduction is that a furnace is never down until it is literally down.

8. Near the end of the life of a furnace, that is when it is about to be rebuilt or altogether destroyed, there is always a large amount of metal in the bottom, where the sole has been eaten out. This must be drawn off while molten or it will have to be dug out,—a very hard and long job. In order to do this, keep the furnace at a high heat with no charge in it. Remove the spout and drill through the lower tap hole (about six inches under the one ordinarily used), with which every furnace is built. This hole must be chipped and drilled out to about three inches in diameter with a chisel bit drill; then a pointed one inch bar can be driven in and withdrawn just as in the regular tap. When all the metal possible has been obtained in this way, the furnace may be allowed to cool off and then be torn down.

II. METALLURGICAL.

The metallurgy of dross smelting is very simple compared to that of other materials. The values in the dross are almost all in the form of clean metal, and the rest is in the form of oxides and sulphides. The metal is simply melted down, and the oxides are reduced with coal. The sulphides, however, are not affected. It takes forced blast to get rid of the sulphur, so they are simply melted down and emerge from the furnace in the form of matte. Incidentally, one of the reasons for the existence of these sulphides can be found in the sulphur which is used to clean the metal in the kettles. There are probably not many complicated reactions, and those which do occur (between dross and fluxes, etc.), are not commercially important because fluxes are used so sparingly.

The one great difficulty to overcome is the fact that

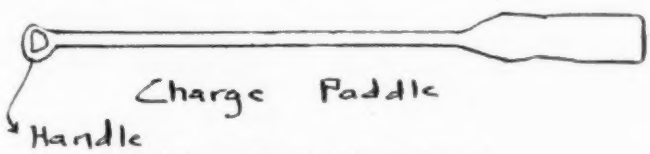


FIG. 8. THE CHARGING PADDLE.

the matte and slag take with them so much metal. It seems that it is impossible to extract all the white metal from the dross without taking with it a large amount of copper. This, of course, would be very harmful to the white metal, except for babbitt. It was found in at least one instance that I know of that it was more advantageous to have large slag and matte losses in order to keep the white metal clean. The matte and slag were sold.

Care must be exercised in mixing the metals on each charge. Some drosses are refractory, others are fairly easy. The following table will give a general idea of the different types:

EASY.	REFRACTORY.
1. Dross containing a high percentage of metal.	1. Dross containing a low percentage of metal.
2. Low per cent. of silica.	2. High per cent. of silica.
3. High per cent. of iron.	3. Residue from sweating rough pigs.
4. Any appreciable amounts of sodium or potassium sulphates or carbonates.	

Alloys of antimony, lead and tin (any two or all three), are easier to sweat than pure lead, because of their lower melting points.

As much refractory material should be smelted at each charge as possible, for financial reasons, but there are very definite limits which must be determined by trial. The less refractory material can be mixed with it to any amount which is necessary.

If possible, it is very advantageous to keep the refractory and the easily-smelted drosses in separate bins.

EQUIPMENT.

Aside from the direct furnace accessories, like the

kettle, extra buck-stays, steel plates, etc., some tools are necessary of which it might be well to make a list.

One large scoop shovel for coal.

Four running bars, 2½ inches in diameter and 9 feet long.

Two tapping bars of same size as running bars, but with broad heads. (See Fig. 4.)

One chisel bar, ¾ inch in diameter and 2 feet long, for chipping out the kettle. (See Fig. 5.)

Two tapping bars, 1 inch in diameter and 8 feet long. (See Fig. 6.)

Two 18 pound sledge hammers.

One 10 pound sledge hammer.

One 3 pound single hand hammer.

One long hoe for smelting operations.

One short hoe, for sweating operations. (See Fig. 7.)

Two medium sized shovels for dross.

Two dippers for casting, to hold about 40 pounds of metal.

Three large ladles to hold about 40 pounds each. They are often necessary during a tap, if the charge is very rich in metal, to cast some of the metal into pigs immediately, in order to keep it from overflowing the kettle.

One long paddle for charging pigs into the furnace for sweating. (See Fig. 8.)

RARE METALS

Some Information Regarding Metals Not Met With in Every-Day Practice.

Uses of rare metals have been outlined as follows by the U. S. Geological Survey:

Antimony—Used in Babbitt and other bearing-metals; type metals; "white metal" alloys used as a foundation for silver plate, coffin trimmings, toys, clock frames, etc.; shrapnel and other bullets and shot. Various salts are used in manufactured rubber, enamels for household utensils and wares, in glass making and in dyeing. Used sparingly in pyrotechnics and medicine.

Arsenic—In the elemental form arsenic is used to harden shot and make them take a rounder form. As arsenious oxide, the "white arsenic" or "arsenic" of commerce, it is used extensively in glass; as an insecticide and weed killer. Many other arsenic compounds are also used as insecticides, and others are used to a small extent in dyeing. Small quantities are used in tanning and medicine.

Bismuth—The metal is used as a component of cliché or low melting-point metals and in solders. The various salts, such as the sub-nitrate, sub-gallate, salicylate and others are used in medicine.

Selenium—Used in making red glass, electrical resistances, and cells for measuring light.

Tellurium—Very little use is known for tellurium. A little has been used in coloring glass, and a patent has been taken out for its use in aluminum alloys.

Cobalt—Used in coloring glass and ceremic wares blue; in "high-speed" tool steels; in stellite (an alloy of cobalt, chromium and other metals, depending upon the use to which it is to be put); and in insect poisons.

Molybdenum—Used in ribbon or wire in electrical resistance furnaces; as supports for tungsten filaments in incandescent electric lamps; in "high-speed" tool steels, and, as ammonium molybdate in the determination of phosphorus, and in other chemical work. It is also used in some forms of stellite, and in the Roentgen ray tubes.

Nickel—The great use of nickel is in making nickel steel. A nickel-copper alloy is used as a jacket for bullets; great quantities of nickel are used in plating various metallic objects; and smaller quantities are used in making coins. The American coin known as a "nickel" contains only 25 per cent of nickel; the rest is copper. Various nickel alloys are proposed as substitutes for steel. Monel metal, an alloy of nickel and copper, containing also a small quantity of iron, is made by smelting the Sudbury (Canada) ores, without separation of the metallic contents. Monel metal is used for valves on high-pressure steam engines; as a roofing material, in sulphuric acid pumps; and in other places where a metal highly resistant to ordinary chemical is needed.

Tantalum—Tantalum now is little used. For a time it was used in making filaments for incandescent electric lamps. It has also been used in surgical and dental instruments, and for pens.

Tin—Tin is used largely as a coating for sheet iron or sheet steel, to make tin plate, ordinarily known as "tin," and of which it forms only 1 to 3 per cent; used extensively in alloys for bearing metals, "white metals," etc.; also in making pipes for organs and in many places where a non-oxidizing metal is required.

Titanium—Used in cast iron, steel, and bronzes, largely as a purifier. Titanium potassium oxalate is used as a mordant in dyeing leather and some textiles. Other titanium compounds find a small use. As carbide, ilmenite and oxide it is used in arc lamps.

Tungsten—The great use of tungsten is as a component of the highly complex alloy steels known as "high-speed" steel. In these 14 to 20 per cent of tungsten is used. It is also used in some forms of stellite (see Cobalt). Smaller quantities are used in incandescent light filaments, in electric contacts, Roentgen ray tubes, phonograph needles, and as an alloy with iron in castings for automobile engine valves.

Uranium—Many experiments have been made with the object of using uranium as an alloy in steel, but they do not seem to have been very successful. Uranium alloys with copper and other metals have been placed on the market to be used in brass and other alloy work, principally as deoxidizers. Uranium salts are used in glass and pottery coloring.

Vanadium—The great use of vanadium is as a component of the "high-speed" and other steels. Vanadium is also used as a deoxidizer in steel, bronzes, brasses and bearing metals. Small quantities of vanadium salts are used in various chemical industries.

Radium—Radium is almost wholly used as a curative agent in various diseases, such as cancer, lupus, eczema, arthritis, etc. A little radium is used in making luminous clock and watch faces, house numbers, etc.

ALUMINUM CONSUMPTION.

The quantity of aluminum consumed in the United States in 1914 was 79,129,000 pounds, against 72,379,000 pounds in 1913 and 65,607,000 pounds in 1912.

LEAD PRICES.

Lead prices averaged 5 cents per pound in 1850, 7 cents in 1864, 3 cents in 1896, 5.7 cents in 1906, 3.9 cents in 1914. The price is now about 5.8 cents.

BRINGING A JEWELRY FACTORY UP TO DATE

THE LAST OF A SERIES OF ARTICLES WHICH EMBODIES ADVICE ACTUALLY GIVEN TO THE MANAGER OF A POORLY EQUIPPED AND OUT OF DATE JEWELRY FACTORY. THE TWO PREVIOUS ARTICLES DISCUSSED FLOORING, LIGHTING, VENTILATION, HOODS, ETC.

BY C. M. HOKE, B.S., A.M.*

(Concluded from February)

THE REFINING ROOM AND ITS EQUIPMENT.

The modern factory has a little chemical laboratory, usually bearing the more modest name of "refining room" or "acid room" in which are carried on such operations as cutting down metals for plating solutions, refining gold and platinum scrap, testing materials, recovering metal from old solutions, and so on. Acids and chemicals of various kinds are stored there, in company with antidotes for poisons, "first aid," and the like. It will be found, in general, that the completeness of the little laboratory is a good indicator of the modernity and efficiency of the factory.

Your acid hood, for carrying off the fumes, should be the center around which the equipment of the acid room clusters, and a sink should be handy. If possible, let the acid room really be a room, with walls, instead of a corner. Fumes should not be permitted to go into the factory, and rouge and dust from the factory should not be permitted in the acid room. Glass partitions are best, since they do not cut off light, and they permit you to see what is going on inside.

The major stationary fixtures of the acid room are the hood with its gas burners, and the sink. Tables, shelves, etc., can be moved around as desired. Happy is the man who can have his hood, his sink, his gas burners, and all his other equipment close together—say within a ten-foot radius. But often there is no sink near the hood, and no room for a table near the sink. In general, try to have the movable fixtures brought up near the hood, even if this leaves you far from a sink. The reason is this: It is easy enough to carry water, but it is uncomfortable or dangerous to carry evaporating dishes of hot acid. But the most important thing is to have good light. Resign yourself to the task of carrying water, if you must; resign yourself to the discomfort of carrying acids, if you must; but do not consent to work in poor or artificial light.

Having weighed the pros and cons and selected the location for your acid room, provide yourself with table, shelves, and utensils. A stone-topped table is a luxury that you may not aspire to, but an ordinary kitchen table with a piece of glass on top of it will do as well. The glass prevents solutions and acids from sinking into the wood. Thin glassware and porcelain are sometimes cracked by being set down on bare glass too roughly; so put a newspaper over the glass while you work, let it soak up any spilled solution, and finally burn it.

Since your sink is some distance away from the acid room, it is necessary to provide a water supply. An old ice-water tank, with spigot and waste jar, will do nicely. A better scheme is this: Place a carboy of water on a shelf over the table, about six feet above the floor. Bend a piece of half-inch glass tubing into a siphon (U shape) to reach to the bottom of the carboy. Connect a long piece of rubber tubing to the outer arm of the U, so that it dangles down over the table, well within reach. At the lower end of the rubber have a little glass nozzle, three inches of glass tubing narrowed to a point, and a pinch-cock or other cheap device to check the flow of the water. Start the siphon by suction, as usual, and then operate with the pinch-cock. An advantage of this arrangement is that a sharp, strong stream is secured by the "head" of water. Some workers use two siphons; one with a large nozzle, for use when water is wanted quickly, and another with a small nozzle for use when a thin, sharp stream is desired.

This arrangement of siphons is so convenient that many workers have a bottle each of hydrochloric and nitric acids on shelves slightly above the table; glass tubing and little glass faucets are commonly used. These attachments are sold by the chemical supply houses, and they cost much less than the layman imagines.

Keep the chemical bottles on shelves, not on the floor. The floor is dusty and unsafe, and it is hard to read the labels. Some fire regulations require that acid bottles stand in earthenware crocks; put a pad of paper, to protect the bottle in case you put it down too roughly, in the crock. Keep the dry powders and crystals, such as ammonium chloride, pearlash, etc., in tight mason jars or porcelain crocks, not in paper bags or boxes, and be sure that everything is labeled. This sounds like superfluous advice, but it is a fact that much loss of material occurs because of lack of labels.

Have one closed cabinet or drawer for filter papers, records, etc., which will not admit dust; then you can leave the filter papers unwrapped and loose in the drawer, where they can be reached easily, and where they will, as is important, keep clean.

SOME NECESSARY UTENSILS.

The following utensils for refining and cutting down metals are what will be needed in a moderate sized plant such as yours, that makes jewelry of good grade; 14 and 18 karat gold and platinum. They can be obtained at the chemical supply houses, and if care is used in the purchase the prices are very reasonable.

1 10 or 15 gallon crock for platinum waste,
1 10 or 15 gallon crock for silver waste,
2 4 or 5 gallon crocks (all with tops, and white glaze inside, if possible.)
1 12 inch evaporating dish,
1 9 inch evaporating dish,
1 6 inch evaporating dish,
1 4 inch casserole,
2 cheap cake-mixing bowls, good size,
1 5 inch porcelain mortar and pestle,
1 16 ounce graduate,
1 cheap 2 quart glass pitcher,
4 glass rods, assorted lengths,
2 funnels, small and large,
1 or 2 wash bottles,
1 Büchner funnel, flask, and pump, complete,
1 or 2 funnel stands.

Some of these items may require explanation. The Büchner funnel with flask and pump is a device for hastening filtration. By means of a small suction pump, fastened to a water faucet, a suction is secured which pulls the liquid through the filter almost as fast as it can be poured in. The pump does not interfere in the normal functions of the faucet, and the whole outfit costs about four dollars. The labor it saves is considerable.

If you have the overhead carboy of water you will not

*Consulting chemist Jewelers' Technical Advice Company, New York.

need the wash bottle, since it serves the purpose of supplying water either in a thin sharp stream, or a larger slow stream; of the two devices, the overhead carboy is preferable to the wash bottle, but its initial cost is higher.

When you buy dishes and pitchers, see that they pour well, and that they sit without wabbling. Have a couple of bits of rubber tubing, about an inch long, to fit over the ends of the glass rod, protruding beyond the end an eighth inch. These are called "policemen" and are used when a precipitate sticks to the sides of a dish and has to be rubbed off.

FIRST AID KIT.

The first aid kit should contain bandages and adhesive tape, pins, vaseline and clean splints for applying it, baking soda (bicarbonate of soda) for burns, zinc ointment for acid burns, peroxide for wounds that may be infected, dilute vinegar for caustic burns. Always wash away acid or caustic with much water before you apply the antidote. Have these things labeled with their names and the purpose to which they may be applied, so that when you get hurt (the victim is as apt to be yourself as anyone else) the most ignorant or frightened helper will not make a mistake. Remember that in your tank of oxygen you have the best possible antidote for poisoning from breathing fumes, smoke, coal gas, etc.

A HINT FOR THE MELTER.

Your gold melting furnaces are pretty adequate, even though they are old. One suggestion, however, must be made—that you provide a little iron table on which to rest your hot ingots and crucibles while they cool. At present you set them on the floor, where there is definite danger of brushing against them, or of their toppling over. If a crucible of molten slag and metal should go over the damage would be considerable. So get a small iron plate or table, preferably with a flange around it, and put it, at a comfortable height from the floor, in some out-of-the-way place accessible to the furnaces.

WASH WATER DISPOSAL.

At present you are catching the wash water of the factory in a series of barrels, through which the water slowly seeps, finally going into the sewer. At intervals you clean out the barrels, obtaining a mass of bulky and offensive material.

Factory regulations in some instances forbid the use of these wooden barrels on sanitary grounds, and insist upon stone or metallic tanks. It will be a good thing for the jeweler when this regulation is enforced, for it will mean that he will eventually save money. He will do this: Tear out the six or eight barrels he now has, and replace them with a couple of small stone tanks, capable of holding the day's accumulation of water, and a filter press outfit. This as you know pumps the water through canvas cloths, which compress the precious material into hard, easily handled cakes, and permit the water to go through crystal clear.

He will find that the cost of running the filter press will be more than covered by the *increase* of precious material captured from the water. Thus, figuring in the depreciation and interest on the investment, plus filter cloths, power for operating, labor of changing cloths, etc., the cost for your size plant is about five dollars a month. This is less than the value of the metal you lose through your barrels, and the material from the press is in an easily managed form. You would probably run the pump for half an hour every night, and change cloths every three weeks.

The practice of having a washwoman come to the factory once a week to wash the towels, wipe rags, and aprons of the employes, is growing rapidly, as it has been found to pay. The only difficulty about the plan, we understand, is that of convincing the washwoman that you really do want to collect and save all the dirty water. Much more precious metal adheres to a workman's clothing than adheres to his hands, particularly if he is wearing woolen clothes; undoubtedly it pays to save wash water from the hand basin, and in the same way it pays to provide the man with an apron and then keep it clean.

Various "settling compounds" are used for coagulating the material in the wash water,—copperas, lime, alum, alum and lime, and so on. Alum with lime is the favorite in this neighborhood, but it is a fact that it is perfectly possible to get along without any settling compound at all. It may be that differences in water, or in methods of working, account for this ability of some plants to get along without settling compound of any kind, so try out your results with and without before coming to a conclusion.

(The End.)

TIN SMELTING IN THE UNITED STATES.

According to a report from the Department of Commerce, Washington, D. C., the American Smelting and Refining Company is now fast completing a tin smelter and refining plant at Perth Amboy, N. J., to handle Bolivian tin ore. It is stated that this is the first attempt to establish the tin industry in this country, but this is not entirely correct as we believe such a plant was started a dozen years ago or so, but failed because of duties placed on the Bolivian ore by the Bolivian Government which discriminated in favor of Great Britain and the ore was then diverted across the water and the American plant had to close down.

Now it is reported that assurances have been given by the Bolivian Government that there would be no further discrimination against the United States in the matter of export duties.

William Loeb, Jr., of the American Smelting and Refining Company, states that the plant for the smelting of tin ores and concentrates and the electrolytic refining of tin has practically been completed and Mr. Loeb also says that the miners in South America are being financed by liberal advances being made upon immediate shipment of the ores from South America.

The establishing of this smelter in this country is particularly interesting at this time as the United States is the greatest user of tin, only a small quantity is mined in this country, and no smelting has been done here. Large quantities are received indirectly by way of England, Belgium and Germany, in normal times. Some of this is from the Straits Settlement and some from the Bolivian mines, the concentrate ore being shipped from the latter country to Europe for further refining. In normal times the United States imports about $50,000,000 worth of tin, which is somewhat more than a third of the world's production. Bolivia produces about $25,000,000 worth annually.

A STRONG PHOSPHOR BRONZE.

The following mixture gives a tough, strong phosphor bronze:

Copper	96 per cent.
Tin	3¾ " "
Phosphorous	¼ " "

A half-inch diameter rod made from this mixture will have 85,000 tensile strength and 25 per cent. elongation in 2 inches. By drawing or cold rolling, greater strength may be obtained, but the ductility is lessened.—J. L. J.

ELECTRO-PLATING ENGINEERING

A Series of Articles Relating to the Operations and Equipment Employed in Electro-Plating and the Reasons Therefor.

By C. B. Willmore

(Continued from January.)

WOODEN TANKS

Solutions for electro-plating are contained in tanks of various materials and somewhat varying designs. The choice of material for the tank is largely determined by its ability to withstand the action of the electrolyte and its freedom from soluble substances which may contaminate the solution and perhaps detract from the quality of the work produced. The purpose of the design of the tank is to form a strong, durable, water-tight container whose seams will not open up under strains and waste valuable chemicals.

The first tank material that suggests itself is wood, owing to its cheapness, which will give satisfactory service provided it is carefully selected and properly treated. Exposed to adverse conditions, however, the life of a wooden tank may become very short indeed. It may be eaten up by the solution, may be destroyed by dry rot, or it may be rendered unserviceable due to swelling and cracking. Dry rot in wood is due to a fungus growth which causes it first to darken in color and then gradually to soften and crumble, at the same time emitting a musty odor. Dampness, warmth and the absence of sunlight promote the growth of this fungus, whereas if the wood is kept thoroughly dry the fungus cannot get a good start. Such fungi are not so apt to thrive in a plating room due to the corrosive action of the chemicals stored in the tanks. If the tank is damp on the outside it is because some plating solution is there, and most plating solutions are good germicides. Wood containing considerable rosin is fairly resistant to dilute acids, but alkalis will attack and soften almost any kind of wood. Even some neutral solutions, such as iron and magnesium salts, have a corrosive action on wood and will eventually work their way through. Swelling, of course, is caused by absorption of moisture and cracking is due to alternate swelling and shrinking as the material becames damp and dries again, or it may be due to temperature changes. The extent to which moisture conditions will cause a wood to crack depends largely upon the nature of the wood itself.

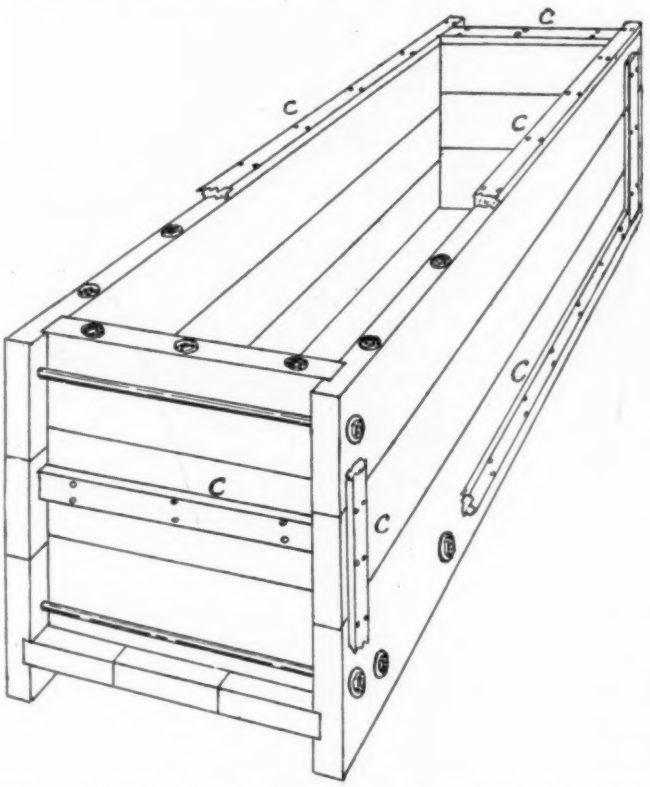


FIG. 4. A SERVICEABLE TANK BUILT IN A PROPER MANNER.

Another fault is the tendency that some woods have towards "slivering." This seems to be caused by the absorption of salts which afterward dry out and crystallize, the crystallization being accompanied by an expansion which forces the fibers of the wood apart. All of these troubles may be eliminated by proper protection of the wood with asphaltum, or some other good water and chemical-proof paint.

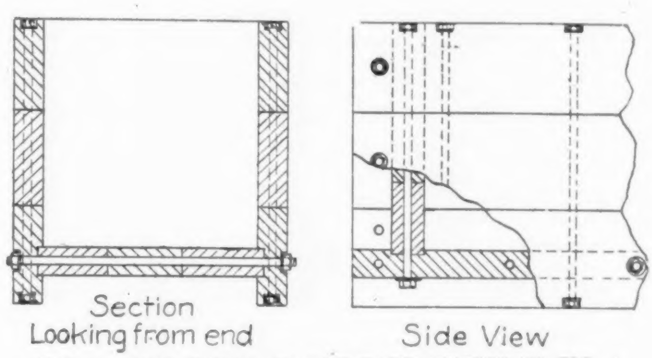


FIG. 5. TWO VIEWS OF THE TANK SHOWN IN FIG. 4.

Since the wooden tanks are nearly always lined with tar or asphalt, the wood need not be particularly resistant to acids and alkalis, provided the lining remains whole. The wood should, however, be fairly straight grained if possible, and free from knots, because knots are likely to push through some time and leave a large hole. It should be well seasoned to prevent shrinking, which would mean open seams, and it should have no tendency toward cracking due to changes in temperature. The actual wood used in any locality will depend very largely upon what woods are most easily and cheaply obtainable in that locality, provided they have the above requirements. The following are the characteristics of a few suitable woods: Bald cypress has but a slight tendency to warp, swell, or shrink. It is free from knots and contains no soluble material which might injure the contents of the tank. It is extremely resistant to decay, even when not covered by a protective coating, and can even be used to hold acid or neutral solutions, such as copper and nickel, without lining, for which purpose it is far superior to other woods under the same conditions.

Redwood has a straight grain, and is free from knots. It has been used without protective treatment for cyanide tanks in the West in the leaching of ores. It does not easily decay, but contains a soluble coloring matter and is somewhat subject to the "slivering" previously mentioned.

Longleaf pine is fine grained and very resinous, which makes it highly resistant to acids. If it is obtained free from knots, it is quite suitable. Sugar pine is very light and soft, the grain is coarse and straight and it shrinks and swells less than white pine. White pine has been

used to some extent for plating tanks, but is somewhat expensive now, and it is difficult to obtain suitable stock free from knots. Neither sugar pine nor white pine can be used without lining. The thickness of the lumber is from two to three inches, according to the size of the tank.

Fig. 4 illustrates the usual manner of constructing a good serviceable tank with minimum danger from leakage. Fig. 5 shows in a little more detail the method of bolting the parts together in order to insure tight joints. The side and end pieces should always be built with the seams horizontal. The ends are sometimes made with the seams running vertically; but this is not good practice, as it means that the seams are supported only at one end and the ends will be weak unless a horizontal piece is bolted across the top of the ends. The edges of the boards that are to fit together must be planed absolutely square and straight, in order to obtain tight seams. This is probably just the point at which many tanks fail which are made by the factory carpenter. It is best not to trust to hand planing but to have the work done with an edging machine, such as are used in sash and door manufacturies. Grooved seams have been tried, but these in most cases have not been as successful as a good square seam.

Having obtained straight, square edges, the next thing is to make sure that sufficient pressure is applied to keep these seams tight against strains caused by the weight of

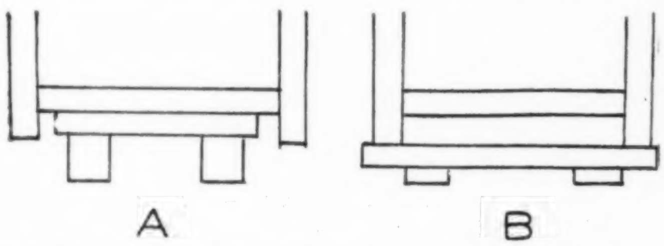


FIG. 6. SHOWING RIGHT AND WRONG WAY TO SUPPORT A TANK. A—RIGHT WAY. B—WRONG WAY.

the solution and by varying temperature and moisture conditions within the wood. This is accomplished by running stay bolts sideways through the edges of the boards at intervals of a foot or a foot and a half as shown in the figures. Sides, ends, and bottom of the tank should all be braced in this manner. At the corners of the tank, mortised joints are usually used, and as with the seams, these should be constructed quite accurately. The sides, ends and bottom of the tank are held together by the stay bolts which are used to produce tight seams, and some extra bolts on the ends, as shown in Fig. 4. Instead of clamping the bottom between the two sides with the horizontal stay bolts, as shown, the tank is sometimes constructed with the sides setting on the bottom, and clamping the sides and bottom together with the vertical stay bolts running through the sides. There is really little choice between the two methods; but it would seem as though the former method should give a little better support to the bottom.

The bolts are quite likely to be destroyed by corrosion if exposed to solution that may drip on them, or to the fumes in the plating room, hence they should be protected by a coating of paint. If they are covered up with cleats, as shown at points C in Fig. 4, they will be much better protected.

Tanks should always be blocked up off the floor, otherwise the bottom is likely to be kept damp continuously, which will give good opportunity for the development of dry rot. This blocking up should be done so that the tank is supported on the bottom as shown in Fig. 6-A, and not on the projecting edges at the side, as in B. This latter method would put quite a strain on the middle of the bottom from the weight of the solution, which might in time loosen the seams.

LINING WOODEN TANKS.

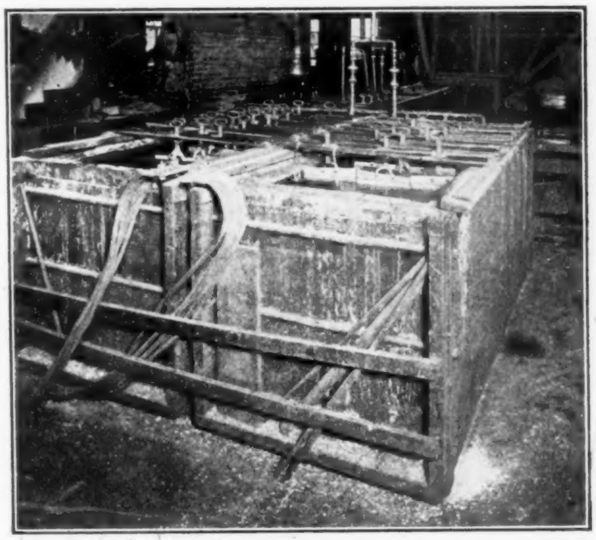
Some tanks with certain solutions will last fairly well without lining, while others will decay quite rapidly, and soluble matter in the wood, such as tannin, may get into the solution and darken the deposit. In any case, it is much better to line the tank and be on the safe side. The material used for lining is usually tar or asphalt and it should have the following properties: It should be free from matter that might be injurious to the solution. Most tars and asphalts are satisfactory in this respect; but one should remember the possibility of the presence of very slight amounts of certain organic compounds effecting quite remarkable changes in the working of the solution, as an example of which may be mentioned the well-known brightening effect on a silver bath, by the addition of

FIG. 7. AN UNLINED YELLOW PINE TANK MADE BY A. J. CORCORAN, INC., NEW YORK.

almost negligible amounts of benzol or carbon bisulphide. The lining material should have a certain amount of elasticity, otherwise in cold weather it may crack, particularly at corners, and thus permit solution to get at the wood. On the other hand, it should not be so soft that it will "crawl" during warm weather, that is, creep down the sides of the tank under the force of its own weight. Various grades of tars are found on the market, ranging from the soft material used as a binder for road materials, to the hard, brittle substance used for covering the tops of dry batteries. The best material undoubtedly is asphalt, of which there are three varieties: Trinidad, Egyptian and oil asphalt. The Trinidad and Egyptian asphalts are from natural deposits in the ground, while the oil asphalt is a manufactured product obtained as a residue in the distillation of western petroleums. Trinidad and Egyptian asphalts are considered the best, as they are quite elastic, easy to work, and are relatively free from crawling. If the lining material does possess a tendency toward crawling, this may be minimized by mixing good, clean sand with it, about one part sand to four of asphalt or tar.

Before lining a tank, it should be quite thoroughly dried by allowing it to stand in a warm, dry place for

several days or a week. Just before the lining is done, all bolts should be tightened. It is often possible to tighten these bolts an inch or more after drying, because of the shrinkage of the wood during drying. It is a good plan, also, to char the surface of the wood slightly with a blow torch just before applying the asphalt. If hot asphalt is applied directly to uncharred wood, particularly damp, or resinous wood, gases are formed which will bubble up through the asphalt and perhaps be entrained in the solidified asphalt, thus producing a honey-comb effect which detracts from the imperviousness of the lining. Charring will prevent the formation of these gases after the asphalt has been applied and will therefore produce a more trustworthy lining. Moreover, the charred surface is somewhat porous, so that the asphalt will penetrate a little way into the wood and thus be more adherent, with less danger of crawling. The tar or asphalt should be melted first in a large kettle and flowed, hot, onto the surface of the wood, which must be horizontal, setting the tank on each side in turn as that side is lined. The corners should be worked afterwards with a hot bar of iron to make them good and tight, and if any spots are discovered where the lining seems thin, these spots may be repaired by melting a little asphalt onto the spot off a solid block of asphalt, and then working it around with the hot iron until a smooth, uniform coating is produced. Water should not be put into the tank before the lining has cooled down to room temperature, as to do so would invite cracking of the lining.



LEAD-LINED TANK AS MADE BY CHADWICK-BOSTON LEAD CO., BOSTON, MASS.

Having lined the tank on the inside, the next thing is to protect the outside against decay from fumes, and from plating solution spilled on it. This may be done with asphalt varnish, thinning it somewhat with gasoline for the first coat, so it will soak into the wood, and applying another and heavier coat later on. The presence of a couple of rows of large black coffin-like boxes around the room may get on the plater's nerves after a while and make him feel as though he is working in a morgue. In case he objects to this death-like aspect, he may substitute for the asphalt varnish, several coats of pigment paint with a white lead base and plenty of good linseed oil, which will make the outside as near waterproof as possible.

The real test of a tank is to put it in service. Many a tank that will hold water very satisfactorily, will leak badly after holding plating solution for a short while. Another strange fact is that plating tanks seem more prone to leak in damp weather than in dry weather, whereas with plain water tanks, dampness causes the wood to swell and makes the joints tighter. Plating salts seem to have the faculty of working their way through tank joints in much the same manner as they creep up over the side of the tank.

A good asphalt-lined, wooden tank will hold any kind of cold plating solution, acid or alkaline. Heating the solution, however, sets up strains in the wood which may result in leaky seams, and where it is possible, a steel tank is to be preferred for hot solutions.

The two most important manufacturers of wooden plating tanks are the A. T. Stearns Lumber Company, of Boston, Mass., and A. J. Corcoran, Inc., of New York, N. Y. In construction their tanks differ very little from the design described in this article. The Stearns Company make their tanks of eastern pine and flow the lining on hot from one-quarter to three-eighths of an inch thick. The Corcoran Company make their tanks of selected yellow pine which they claim is of such a quality that no lining at all is needed.

LEAD-LINED TANKS.

For some purposes, lead makes a very good tank lining. Lead is not attacked to any extent by either warm or cold sulphuric acid of strength less than about 60 per cent. It is soluble in hydrochloric and more so in nitric acid. It resists the action of moist air, but plain water and solutions of nitrates, nitrites, chlorides, tartrates, citrates, acetates, decaying organic matter and a few ammonia compounds act on it slowly. Sulphate salts and alkaline carbonates have very little action on it. Lead should not be used to line cement tanks, as having it in contact with cement causes it to become brittle.

By itself lead cannot be used as a container for large amounts of solution on account of its weakness. It is used therefore only as a lining for a wooden or steel tank for plating purposes which serves to strengthen the lead against the strains of the weight of solution it holds, while the lead in turn protects the wood or steel from corrosion by the electrolyte. Since the lead does not have to withstand any great strains it need not be very heavy; and as it is somewhat expensive, plating tanks are usually lined with the thinnest lead which will withstand the wear and the slight action of the electrolyte. The usual thickness is about 1/8 of an inch for medium sized tanks up to 1/4 inch for large tanks.

A metal container will always carry part of the current from the anode to the cathode through its metal sides. This does not occur necessarily because the tank rods are poorly insulated; but the point is that metals are very much better conductors than electrolytes. Accordingly, some of the current is going to find its way through the electrolyte from the anode to the metal sides of the tank, which is usually a rather short path, and will then flow through the metal to the region which is closest to the cathode. Here it will leave the metal and pass back through the solution to the cathode. The extent to which this will occur depends entirely upon the relation between the resistance of the direct path through the electrolyte from anode to cathode, and the total resistance of the path from anode to metal sides, through metal, and back through electrolyte to cathode. This is in accordance with a general rule for split electrical circuits, which states that when a current has several possible paths, the amount that will flow through each path is proportional to the conductivity of that path. In most cases, the path between the metal side and the cathode plus the path from the anode to the side has very much lower conductivity than the direct path, so that the amount of current flowing

through the metal container is small. It may, however, have its effect in spite of its small size. If seams in the lining be made simply by lapping over and riveting, the result is a high electrical resistance at this point, so that some of this stray current will go from one sheet a short distance out into the electrolyte, through this and back again to the other sheet. This means that electrolysis is being carried out here, and since the action is concentrated on this small area, the effect is likely to be quite apparent and may corrode the metal along this seam and open it up sufficiently to permit loss of solution. This kind of corrosion is known under the general title of "corrosion by stray-current electrolysis."

On the other hand, suppose the seem is soldered, which ought to make good contact between the two parts and prevent stray-current electrolysis at the joint. No two metals have the same electrical potential, so whenever two dissimilar metals are in contact in an electrolyte, a local battery is formed whose effects may be just as bad as the stray-current electrolysis. This kind of corrosion is known as "corrosion by galvanic action." The thing to do to prevent both of these troubles is to have the seams "burnt" with the oxy-hydrogen blowpipe, which will make a joint that is perfectly uniform in material and continuous.

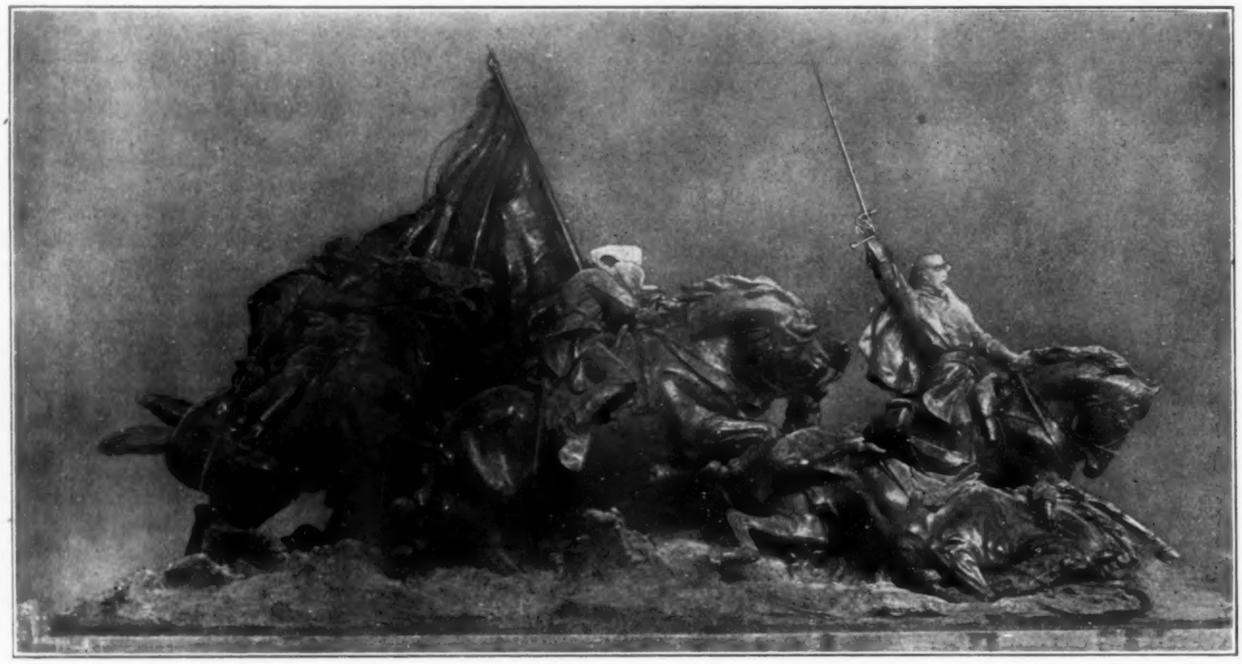
When heated, lead expands as other metals do, but when it cools it does not contract in the same ratio that it expanded. This is likely to cause bulging of the lining if hot solutions are worked in lead-lined tanks. The lining should be bent up over the edges of the tank and down a short ways on the outside, which will protect the edge of the tank from injury by dripping solution.

The tank rods should be well insulated from the lead lining, for if they are not, several troubles may result. If both anode and cathode rods are in contact with the lining, a short circuit will result with corresponding loss of power and perhaps damage to conductors. If the cathode rod alone is in contact with the lining, then the lining will act as a cathode and part of the metal from the solution will be deposited on it and thus effectively wasted. If the anode rod is alone in contact with the lining, then the lining will act as anode and part of the current will enter the solution through it. If the metallic lining is soluble in the solution when used as an anode, then the solution will be contaminated. If the lining is insoluble in the solution, the effect is that part of the current which plates out metal on the cathode is engaged in forming oxygen at the lead cathode, so that the efficiency of corrosion of the anodes is greatly lessened and the solution will be correspondingly impoverished of metal, necessitating the addition of the metal to the bath in the form of salts.

Lead-lined tanks have been used to some extent for containing sulphate copper and nickel solutions since lead is insoluble in sulphates; but have not found much use for containing cyanide solutions. It is best not to use hot solutions in then on account of the bulging tendency of the lead, already referred to. Other metals should not be allowed to remain in contact with the lining in the electrolyte, such as when work falls to the bottom of the tank, because this is apt to set up galvanic action which may have some corrosive action on the lead.

The Chadwick-Boston Lead Company of Boston, Mass., are the principal makers of lead-lined tanks. They make their tanks of wood, usually two-inch or three-inch cypress, and sometimes pine and spruce, lining same with highest quality chemical sheet lead with all seams burned, the lining being brought up over the edge and down about an inch on the outside to protect the edge from drippings. The thickness of the lead is usually about one-eighth of an inch.

(To be Continued.)



CAVALRY GROUP CAST IN BRONZE FOR THE GENERAL GRANT MONUMENT AT WASHINGTON, D. C.

This group was cast by the "Cire Perdue" process at the foundry of the Roman Bronze Works, Ricardo Bertilli, proprietor, Brooklyn, N. Y., February, 1916. The group is 28 feet long, 10 feet wide, 12 feet high, and weighs 31,400 pounds. The group forms the second of four which is to adorn the Grant Monument. The first group, representing Artillery, was finished at the same foundry in October, 1911, and was shown in THE METAL INDUSTRY, January, 1912. The architect is Edward Pearce Casey, and the sculptor Henry Merwin Shrady.

THE ORIGIN OF THE WATCH

A Concise Story of the Development of This Important and Useful Article

In his address on "The History of the Watch Industry" before the students of the Trenton School of Industrial Art, George F. Eberhard, general manager of the Trenton plant of the Ingersoll-Trenton Watch Company, traced the development of watches from the time of their invention in 1500 down to the present day, showing in a comprehensive and interesting way how the manufacture of the watch has progressed along scientific lines. He said:

"We learn from books of record the first watches were made in the year 1500 in Nurenberg, Germany. They were made of iron, all parts, even the dials. Brass was substituted in 1530 and in 1550 watches began to come into vogue. In 1570, odd shaped watches, hexagon and octagon shape, began to be fashioned. It was not until 1587 that the watch industry began in Switzerland. The fuzee chain was invented by a Swiss by the name of Gruet in 1590. Up to this time a catgut cord was used. Watch crystals made of glass were first made in 1615. Enameled dials were first made in 1635. The balance spring (known as hair spring) was first made in 1676.

"It is said they were made from hog bristles, and that is how the name hair spring originated. The minute hand device was first made in 1687, which provided the hour and minute wheels and cannon pinion, which carries the minute hand. The first keyless watches were made in 1700. The compensating balance was invented in 1749. The duplex escapement was first made in 1750.

"The lever escapement, so largely used now, was invented in the year 1776. Second hands were first used in 1780. Thin watches were first made in 1776. It will be noted all important inventions for making watches were not made in America, even the thin watch, as stated, was on sale in 1776, when we were fighting for our independence.

"The difficulty with European watch manufacturers was that one small factory would make wheels and another staffs and so on, by hand, with the result, in some places, thirty-four small factories would make parts that would be finally assembled, requiring much hand work fitting these 150 parts together, depending upon the mechanical skill of the workmen as to getting the watch to run and secure a timing rate.

"The American watch factories have developed the manufacture of watches so that all parts, including the cases, are made in one large factory with modern machinery, largely specially designed and built for making the parts as near as possible in duplicate and interchangeable.

"The first watches were made in the United States by Luther Goddard, of Shrewsbury, Mass., in 1812, making two watches per week and after making about 500 watches, he retired from the business in 1817. About the same time a small watch factory was started in Worcester, Mass., which soon failed. In 1838 the first watches were made by machinery by James and Henry Pitkin, of Hartford, Conn. They produced about 800 watches and retired in 1841. In 1848 Aaron Dennison commenced to develop machinery and with E. Howard, the first watches were put on the market in 1853 under the name of "Boston Watch Company," making five watches per day. In 1854, Dennison moved to Waltham and the company failed in 1857. In 1859 the Waltham watch industry was reorganized.

"In 1865 several employees of the Waltham factory removed to Elgin, Ill., and established the Elgin watch factory. Some of the employees then left Elgin and started the Rockford watch company and Springfield Watch Company. Ambrose Webster, who learned his trade as machinist and toolmaker in the Springfield armory, Springfield, Mass., noted for fine machinery equipment for doing accurate work, and for some years foreman of the Waltham factory, beginning in 1857, left them in 1876 and started the American Watch Tool Company, which company furnished the machinery for a number of watch factories. Some failed in years following and the machinery changed hands, resulting in the establishment of the Hamilton, Deüber, South Bend and Trenton watch factories.

"A new era in the watch business began in 1890, when Robert H. Ingersoll developed the first guaranteed dollar watch, which is manufactured at Waterbury, Conn., producing over 15,000 watches per day, or about six times more than any other watch factory in the world. They are shipped and handled by over 60,000 dealers in every civilized place on the earth. The success of the dollar watch has led to the production of higher grades, following the Ingersoll slogan, 'Not what we can get, but to give all we can for the price." This accounts for the success of the Ingersoll-Trenton watch factory, which will soon reach the 1,000 per day output of the New Ingersoll reliance watch. Up to this time orders have been in excess of production, resulting in being several thousand behind orders."

METAL CONTENT OF PLATING SOLUTIONS.

By Chas. H. Proctor.

The metal content of the various solutions should be as follows:

Still Solutions.

Single nickel salt	2.50	ounces metal per gal.
Double nickel salt	1.60	" " " "
Copper (cyanide)	3.50	" " " "
Copper (acid)	4.50	" " " "
Brass solution	3.50	" " " "
Silver	3.00	" " " "
Gold (hot)	0.25	" " " "
Gold (cold)	0.75	" " " "
Zinc (cyanide)	2.50	" " " "
Zinc (acid)	4.00	" " " "
Tin (hot)	1.50	" " " "
Platinum	Same as gold.	

To determine the metal content of any solution the electrolytic method is the simplest. A given quantity of solution is measured out and a platinum tube or shell is used as the cathode. This tube or shell should be weighed carefully first and then the solution set up. It is advisable to use platinum as the anode, although carbon may be used. Agitate the solution and apply a strong current until all of the metal is deposited out of the solution. Dry the platinum tube or shell after carefully washing in water and alcohol and the weight of the metal contained per gallon of solution may be determined by deducting the original weight of the shell from the total weight of the shell and metal deposit. Platinum is the best material to use, but any metallic shell may be used.

SPECIFICATIONS FOR ALLOYS FOR HIGH-SPEED SUPER-HEATED STEAM TURBINE BLADING*

Non-Ferrous Materials Formerly Used; and of Some Worth Further Consideration for Turbine Blading Purposes.

By W. B. Parker, F.I.C. (Rugby.)

(Concluded from February)

BRASS ALLOYS.

The following results will suffice to show that no permanent progress appears possible amongst the brass type of alloys, and the author sincerely hopes that these results will turn the attention of British manufacturers off this worn-out track on to others which better warrant immediate original investigation. The problems will not be solved by the invention of fancy names and quotations of high prices.

To combat the argument that brass is sufficiently good for blading the lower-pressure end of turbines, Fig. 5 is given. It will be noticed that it is a case of erosion from wet steam—water erosion, a defect to which brass is liable, because it is too soft *per se*.

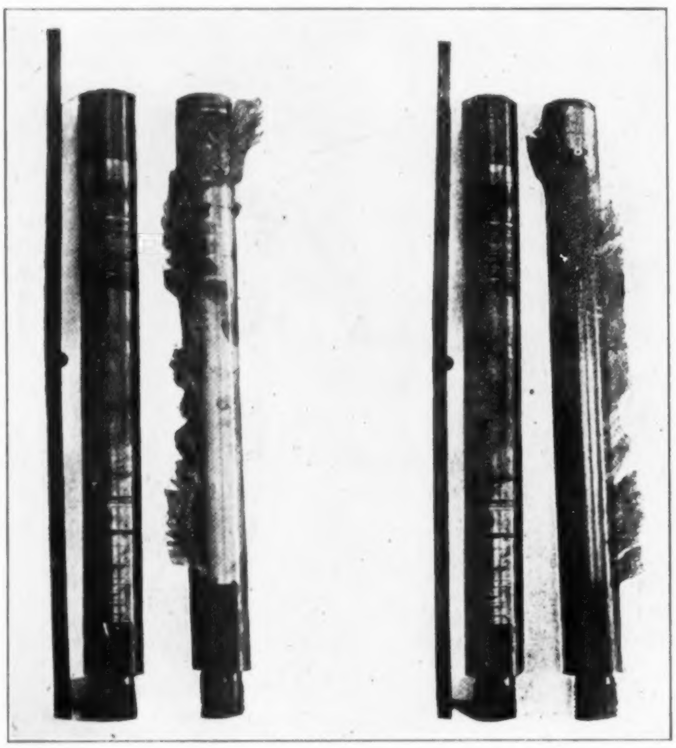


FIG. 3. FIG. 4.
SHOW EFFECTS OF RAPIDLY RELEASING STRESSES INDUCED BY COLD-WORKING THE SURFACE OF A PURE COPPER BAR.

Many modifications of the three typical brasses 70:30, 60:40, and 52:48 have been proposed and tried, and these include practically all the so-called manganese bronzes and brasses. No definite advantages have been found in their use, and in the long run they behave like ordinary brass.

INCLUSION OF UP-TO-DATE REQUIREMENTS IN SPECIFICATIONS.

It is easier to enumerate the points which should be considered by anyone desirous of improving upon the present supply of blading than to express these in a form which can be considered a specification, because the latter really necessitates the insertion of concrete values for each, and concrete values are influenced by progress in design.

It is hoped that the following synopsis will answer this purpose:

NON-FERROUS BLADING.

(1.) General.—The metal should be in a physically stable condition; that is, either naturally soft or in the annealed state requisite to ensure that it is free from unstable internal stresses.

(2.) Proportionality Limit.—The metal, when in the above naturally soft or unnealed condition, should possess a proportionality limit of over 16 tons per square inch.

N. B.—Since at present 12 tons per square inch is the best obtainable, and is considered as the minimum acceptable, a non-ferrous metal which in the above condition possessed a proportionality limit of over 16 tons per square inch, and also fulfilled clauses iii., iv., and v., would be a distinct advance upon present materials.

(3.) Constancy of Proportionality Limit.—The proportionality limit of the metal in the naturally soft or unannealed condition should remain constant within 10 per cent. of its cold value over the whole range of temperature from 100° C. (212° F.) to 400° C. (844° F.).

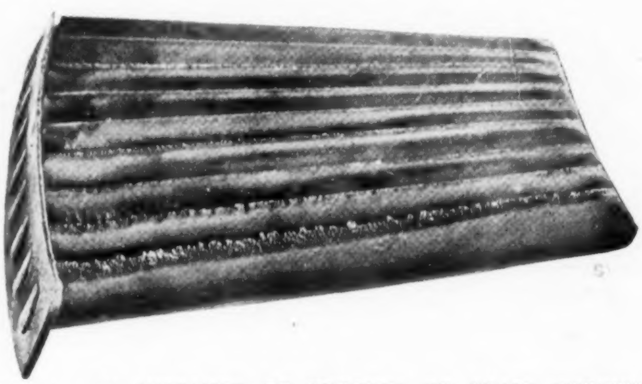


FIG. 5. AN INSTANCE OF EROSION OF BRASS TURBINE BLADES BY WET STEAM ("WATER EROSION").

(4.) Maximum Stress (Tensile Strength).—The maximum stress of the metal in the naturally soft or annealed condition should exceed the proportionality limit by not less than 100 per cent.; that is, the ratio of

$$\frac{\text{proportionality limit}}{\text{maximum stress}}$$

shall be not greater than 0.5. The ratio should remain constant over the whole range of temperature from 100° C. (212° F.) to 450° C. (844° F.).

N. B.—Usually in sound metal the ratio $\frac{\text{proportionality limit}}{\text{maximum stress}}$ = 0.35 to 0.5 except where some cold working is left in the metal. At present the minimum acceptable maximum stress is 24 tons per square inch, which gives a ratio of 0.5 on the 12 tons per square inch proportionality limit. It is more common to stipulate the minimum maximum stress and then express the proportionality limit as a minimum percentage of that, but for turbine blading it is preferable to reverse this order, and, in fact, the author has had need to alter specifications of other turbine metals in a similar way for similar reasons, viz., to prevent excessive reliance upon cold working.

*Read before the Institute of Metals, England, at a recent meeting.

(5.) Corrosion and Erosion.—The metal must be non-corroding and non-rusting in damp steam. It must also resist erosion by steam.

(6.) Hardness.—The greater the natural hardness of the metal in the soft or annealed condition the better, provided it is obtained concurrently with the other necessary properties.

The hardness of the best non-ferrous materials now available lies between 10° and 15° Shore's test (scleroscope), so that a new metal having a natural hardness of 30° would be an advance.

(7.) Thermal Expansion.—This should preferably be low, but provided it does not exceed the expansion of the non-ferrous materials now used, it would answer. A metal having a constant coefficient between 100° C. and 500° C. is desirable, and metals with violent changes of

FIG. 6. ENLARGED VIEW OF THE WORST BLADE IN FIG. 5, SHOWING FURROWS, PERFORATIONS AND GENERAL EFFECTS OF WATER-EROSION UPON THE EDGE OF THE CONVEX SIDE, WHICH IS THE "LEADING SIDE" AND ENTRANCE EDGE OF THE BLADE.

coefficient due to critical points or ranges should be avoided.

(8.) Ductility.—The ductility, as evidenced by "elongation per cent." and "reduction of area at fracture," need not be great, because it is not, *per se,* of special value.

The elongation should not be less than 10 per cent.; the reduction of area not less than 20 per cent.

(9.) Specific Gravity.—The lower the specific gravity of the metal the better; but only if obtained with items 2, 3, 4, 5 and 6.

(10.) Resistance to Vibratory Stress.—Under certain conditions vibration stresses are exerted on the blading, but the examination of this question is so difficult, that little is yet known regarding them. Until they can be more specifically defined by the designing engineers, it is best to narrow attention down to the other items mentioned.

FIG. 7. ENLARGED VIEW OF THE CONCAVE SIDE OF THE WORST BLADE OF FIG. 5, SHOWING THE SAME IMPERFECTIONS AS FIG. 6, BUT THE ABSENCE OF FURROWS BECAUSE THIS IS THE SHELTERED SIDE OF THE ENTRANCE EDGE OF THE BLADE.

N. B.—It might be mentioned that heat-treated steels, with artificially enhanced properties, have not given so good a result under Professor Arnold's test as the same steels in the natural soft or annealed condition, so that, by inference, non-ferrous materials in the soft condition are preferable.

SUGGESTIONS RE RESEARCHES

For a complete research upon selected materials there is required a series of tests which aim at ascertaining the possible value of the materials under working conditions.

These can be divided into three kinds, and if a material gives promise in the first two, the third test can be narrowed down to suit specific conditions appertaining to the design of any turbine.

(1.) Stress and Time (duration of stress).—A series of tension tests at ordinary temperature, with loads ranging from a ton or so below to a couple of tons beyond the proportionality limit with variation of duration of the stress.

If the metal is only for use in the low-pressure and temperature end of the machine, this test gives useful data, and may suffice.*

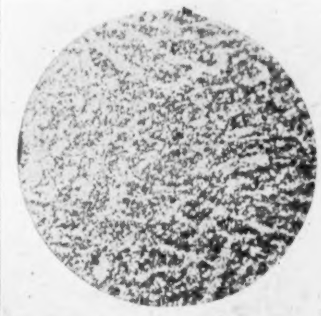


FIG. 8.
Wrought Brass containing Manganese, Iron, and Aluminum.
Sample C 11. In condition as received.
Longitudinal section. Etched with ammonia.
Magnified 31 diameters.

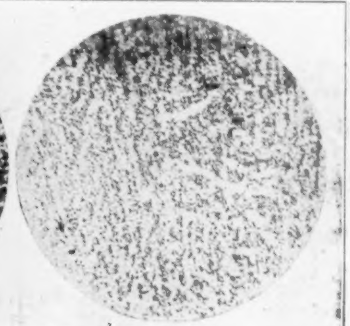


FIG. 9.
Wrought Brass containing Manganese, Iron, and Aluminum.
Sample C 11. After annealing for 100 hours at 235° C.
Longitudinal section. Etched with ammonia.
Magnified 31 diameters.

(2.) Stress and Temperature.—This is a series of tension tests at increasing temperatures, but including the proportionality limit determination for each temperature.

It serves to detect any weakening due to the effect of short durations of increased temperature.

(3.) Stress, Temperature, and Time.—This series can be limited to particular problems of design. It correlates the effect of a specific duration of a specific range of stress at any specific temperature. It should include the

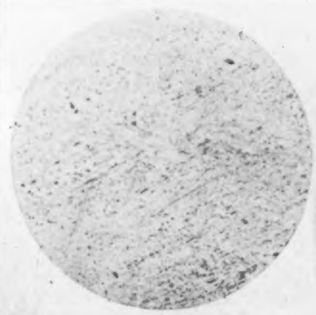


FIG. 10.
Forged Copper-Aluminum-Nickel Alloy.
Sample R. Transverse section. Polished only.
Magnified 31 diameters.

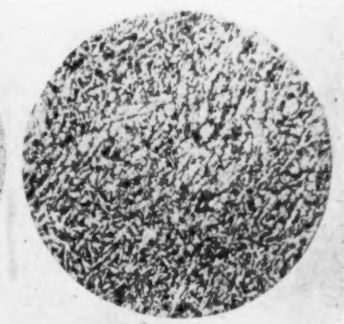


FIG. 11.
Forged Copper-Aluminum-Nickel Alloy.
Sample R. Transverse section. Etched with ammonia.
Magnified 31 diameters.

determination of the proportionality limit for each set of conditions.

Examples of the second kind have been published in the Journal of the Institute of Metals. There has been

*This is not a "fatigue test" in the strict sense in which this term is usually applied in Great Britain and on the Continent. But in U. S. A. the term "fatigue" is utilized more loosely, and, the author thinks, incorrectly. It has been so applied by Mr. Ernst Johnson to his "stress-time" test, or "creeping effects," published in June 1915 in a "Reprint of the American Society for Testing Materials," entitled "Fatigue of Copper Alloys."

very little published upon the third series, but some information is available in a paper published by Professor R. Stribeck. The practical value of such tests is great.

To prevent manufacturers being discouraged by the above array of tests, it may be stated that only very promising materials need be put through the whole of the above research scheme. A rapid sorting out can be effected by a short scheme, such as accurately determining the maximum stress, proportionality limit, modulus of elesticity, elongation, and reduction of area upon cast materials thus, use: (1) Dry sand cast bars of the material, having a cast section of not less than 1⅝ inch diameter. If these give good results, then (2) repeat the tests upon a similar bar after annealing it for four hours at 500° C., and cooling so slowly that it is in the natural soft condition.

If a good proportionality limit is obtained for the annealed casting, and the other properties are not lowered below the allowable minima, proceed to roll, draw, or otherwise work the metal into sections of, preferably, ½ inch diameter or ½ inch by 1 inch flats, and anneal these so that they are in the natural soft condition. Then, using these—(3) Determine the same physical values as in (1) and (2). If the tests are still satisfactory, then thoroughly test it according to the larger scheme, either entirely, or Parts II. and III.

The microstructures of the specimens from (1), (2), and (3) also form a very good guide in sorting out.

If the structures show what can be termed imitations of steel structures—especially of the pearlitic structure—they probably possess a naturally good proportionality limit. In fact, the author believes that by striving to find non-ferrous materials which naturally have steel structures, the naturally strong alloys now in demand will be discovered. The paper on "The Widmanstätten Structure in Various Alloys and Metals," by Captain Belaiew* and the communications contributed to it give very useful directions upon this point.

Having now, for reference purposes, a statement of the nature and present position of the turbine blading problem, it is for the non-ferrous trade to bring forward the material and to recover the ground they have lost to the steel trade; but it should be noted that only materials which have been fairly completely investigated by its advocates upon the lines named above, and which really give promise of improvement, will be welcomed by turbine makers.

Frank exchange of test data is desirable, for turbine makers are not in business to test anything and everything which the brass manufacturers think original and an improvement.

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FIG. 12.
Copper-Aluminum-Nickel Alloy "K" heavily forged. Transverse section. Etched with ammonia. Shows flow lines due to forging. Magnified 31 diameters.

FIG. 13.
Same specimen as shown in Nos. 12 and 14, but magnified 250 diameters.

FIG. 14.
Same specimen as shown in No. 12, but more deeply etched to illustrate size of crystal grains.

*Journal of the Institute of Metals, No. 2, 1914, Vol. xix, p. 46.

SAWDUST VERDE FINISH.

The "sawdust verde" finish is produced by moistening maple sawdust with any of the usual verde green mixtures and then covering the articles with the sawdust until the green verde forms. It is advisable to use a steam heated sawdust box for the purpose so that the sawdust may be made slightly warm. The action is then quicker.

The sawdust is removed by brushing or by air pressure and after the articles are dry they may be either lacquered or waxed. The following mixtures may be used:

1.

Acetic acid	1 pint
Sal ammoniac	4 ounces
Common salt	1½ ounces
Cream of tartar	1½ ounces
Acetate of copper	1½ ounces
Water	4 ounces

2.

Water	1 quart
Zinc sulphate	4 ounces
Sulphate of copper	1 ounce
Sal ammoniac	1 ounce
Glycerine	¼ ounce

3.

Water	1 quart
Copper potassium chloride.....2 to	4 ounces

This copper compound will give a green upon silver, brass, copper or bronze.—C. H. P.

BETTER FOREMEN—AN ECONOMIC GAIN

Some Arguments in Favor of the Get-Together Spirit Among Electro-Platers.

By Thomas Brown.*

The electro-plating industry is advancing and almost daily something promoting this art is being discovered or applied. Much of this progress has been due to the admirable work of the American Electro-platers' Society. This organization, in the few years of its remarkable growth, has had a salutary influence for good upon the entire membership; composed as it is, mainly of active, practical workers in a field of applied science, which only a few short years ago was so little known to the vast majority of people, that the entire industry and the most simple operations incident thereto were hedged about by a wall of mystery, uncertainty and tradition that did more to retard the natural growth and application of this art to articles of our daily life than anything else that can be mentioned. But the deadening influence of this lack of knowledge was felt more keenly by the manufacturer than by the general public, whose interest is only passive. The manufacturer had to make use of the applied science of electro-deposition of metals in his business. His interest was a real, live interest and he suffered losses in direct proportion to his plater's knowledge or lack of knowledge of the science.

There cannot be any doubt as to the very material good which this organization has done for the individual platers composing the membership, and the world at large owes not a small debt of gratitude to those men who first conceived the need for an organization of this sort devoted purely to education and then had the energy and ambition to work toward the fulfilling of that need. This Society is here to advance the art of depositing metals and to make of the exponents of this art better, broader and more efficient workers in their chosen field. And no one can quarrel with the statement that it has succeeded in large measure in the accomplishment of the objects which brought about its organization.

At the same time we cannot afford to overlook those independent investigators who have contributed so much to our present knowledge of the subject. They deserve much credit and without them we should suffer a distinct loss. In fact, the work of the American Electroplaters' Society is intended more to stimulate active interest in plating than anything else. So one is as essential as the other.

With all that has been done there are still a few platers who, through lack of initiative, personal bias or crass stupidity fail to benefit by the knowledge which has been gained and which is free to all who will read and ponder. There are today, foremen platers who are holding down good jobs at good salaries who manage to "get by" in some mysterious fashion, but their success in surmounting their difficulties is in no sense due to their superior attainments. Rather, it is quite likely, it rests upon the supreme ignorance of their employer, of all things pertaining to the plating room. He does not know and can hardly be expected to know how to intelligently criticise his plater.

Of course, these men are in the very great minority. As stated, their employers are to blame. Some years ago the plating department was a chamber of mysteries to the average employer, and anything that Mr. Plater said went—unquestionably. It did not matter if the plater knew not what he was doing—neither did the Boss. Solutions were made with all sorts of strange, unrelated chemicals in them, simply because somebody at some vague time had suggested their use. Mr. Foreman Plater jealously guarded his "mixtures" from everybody. He was doubtless afraid, that someone else would learn his "secrets" and take his job away from him. It was a common occurrence for a shop to have a good part of its output tied up for days and sometimes weeks in the plating department, because one or more of the solutions were out of order.

Happily, these days are of the past and it is now an exception to find any plating shop operated on such an unscientific basis. This is because the plater of today knows more about the technical and scientific part of his job than his predecessor of some few years ago. But, it is a fact that a great many of them stop right here, and instead of knowing something about management in all its relations to labor and material, "fall down" hard when other questions arise which necessitate some application of the broader principles of executive action. The author is not saying that in instances of the sort referred to that these men do not "get by" and give satisfaction. But that they could accomplish their work more efficiently and with less waste of labor, time or material than they do and give greater satisfaction, if they were really executives.

How many foremen know definitely what their departments are costing to maintain and operate? Or what their actual output really is and what percentage it represents of any given period of time in the past? What it costs per square foot of surface plated, including all charges for labor and materials? What percentage of the total cost is for overhead labor or materials? For productive? For unnecessary operations of any and all natures? How many know how often or can readily tell each man's output? Or how often and on what day any man is either late or absent? How many know the exact quantity and the monthly or weekly cost of each and every chemical added or used in maintaining their solutions in proper condition?

There are not many, it is safe to say, who can answer all of these questions affirmatively. Some will tell us that they are Foremen Platers—not Cost Clerks. Others will say that it is unnecessary for them to know all that as the Front Office has such information, and they are only concerned with turning out a good day's work. These are good, legitimate reasons—so far as they go.

Take the labor problem first, as that is the most expensive thing they use. And it is the most easily wasted of anything in the shop. A little reflection on this point will reveal just why this is so. If a record were kept by the foreman of every man under his direction, the foreman would know absolutely who his best men were and why. He could go to the "front" fearlessly and convincingly for a wage increase for any man deserving it, and if he were criticised on any point relating to labor or labor-cost, he could most surely and instantly justify himself—if that were at all possible and if it were not possible, he himself, would know it and be convinced of it. He would thus learn something. For we never truly learn anything until we believe in it and we do not believe until we are convinced. The keeping of such a record is a simple thing and should only require a few minutes' time each day.

*Assistant superintendent, Tuttle & Bailey Manufacturing Company, Brooklyn, N. Y.

Production records are a simple matter to obtain in any plant. In nearly every case it merely requires that a copy of the regular record which goes to the office, be retained by the plating department. The extensions necessary to properly tabulate the information contained in this record should not be an arduous task, and inasmuch as records and the character of the work vary in different plants, there is not much that can be said upon this subject here. But as an accurate record of this nature is absolutely essential for any system of costs or information, its importance cannot be minimized.

It is an easy matter to keep track of everything which is added to a plating tank if the quantity is noted down at the time such addition is made. This will have to be done methodically to be of value. By obtaining the costs of each material purchased and handling such information on a unit basis, there should be little work and no trouble in figuring out the value of each quantity of any raw material used. This information should be properly tabulated and posted to a daily, weekly or monthly record as desired.

There is nothing wonderful or startling in the simple systems indicated. They are substantially the same as obtain in most up-to-date plants. They can be extended or changed in any way to suit conditions or the requirements of any situation. Records furnishing the individual output of any man or machine can be as easily obtained by means of most of the information available in the average plant. When this is at hand it is a simple matter to get a direct cost on any particular operation.

Where the instruments are available, it is quite easy to know the exact amount of the current used on any or all tanks, and from there it is only a step to reduce this information to dollars and cents.

The keeping of such records as are outlined here are intended only as an aid to the foreman in charge of the department, and are suggested for the sole purpose of making him something more than a mere plater. These records may seem unnecessary to some and may even be considered a waste of time, but any man in charge of a department who tries keeping them and studying them, if there are no others to which he has recourse, will appreciate their practical value to himself in a short time. They will mean an added, tangible, dollars and cents value to his services, by making him a master of all phases of his job. They will assuredly add a large store to his knowledge and to his control over his job. His employer will be benefitted in many ways, chiefly, however, in having in his service a capable, painstaking man, thoroughly informed about his business—in short a man who will have a keener appreciation of his obligations to his employer. And if the man be a natural manager, possessed of resourcefulness and plenty of native ability, then, that man will be in every sense of the word an Executive.

What has been said here relating to the Foreman Plater as regards his lack of appreciation of his position as an executive authority, can be applied with equal force to any other position of similar importance. This article is intended to stimulate on the part of those men to whom leadership is given by the employer, a desire to make of themselves something more than mere artisans engaged in a certain occupation. It is intended to awaken in those that need it, a desire to be real executives, able and willing to think for themselves on all matters pertaining to the department under their charge, and not only on certain few matters which require their attention and to which the employer through lack of scientific knowledge or press of business is unable to attend. His need of their services is real and established, and who can say that he would not welcome the services of a man who knowing his technical job thoroughly, as the average foreman plater probably does, knew in addition to that, the How and the Why of management? Many men engaged as foremen do know all this, and these men are generally found to be occupying the "big" jobs in the trade. No man should so bury himself in his own little world of plating, casting, building or what not, that he is unable to see and appreciate something of the larger world that surrounds him, and which, whether he knows it or not, concerns him and in some way affects himself or his welfare. The broader and more extensive our knowledge and the more expert we become in applying that knowledge, determines in large measure our economic worth. In other words, the more valuable we make ourselves to our employers and society generally, the greater will be our reward. Is it not worthy of attainment?

BLISTERING OF GOLD ALLOYS

By H. D. Coleman.*

My experience has been that where high grade metals are used say: gold of 999 + fine and electrolytic copper of highest grade, and ordinary care is exercised to keep surface of melt covered with charcoal, and not pour it too hot,—start at 1010°C. there should be no blister troubles. Cold moulds not properly greased may make trouble; warm moulds and cover thoroughly with a film of pure lard.

You will find that both a more ductile and homogeneous ingot will result if the metal is not poured too hot.

Blisters of course, originate in the melting room and usually represent oxide in solution or entrapped gas. The minute volumes of porosity or voids as far as the metal is concerned, can not be detected in the ingot or in the ordinary rolling process, unless the ingot is machined ostensibly for this determination. However, when the annealing heat is applied to the strip these blisters assert themselves, as they can now do, their cover or shell being thinned sufficiently until it can no longer withstand the pressure of this entrapped gas without deformation. The smaller the gauge the thinner is the cover over these voids and the easier the expansive force of the gas does its work; while in the bar, though the gases are highly heated the cover is too thick to permit of distortion.

An annealing temperature of 650°C. is about right for annealing here and care should be taken that it does not increase much over this amount. If the metals are not highly refined, you are liable to have blisters, besides the ingot will not be homogeneous and tough and may break or split in the strip. If metals are thought to be of highest grade and resultant ingots are void of ring and lack malleability, I think a treatment of the melt with cupric chloride may greatly facilitate the working of it. This commercial salt; $CuCl_2 + 2H_2O$ is heated slowly until the water of crystallization is driven off, then the mass may be poured into any convenient size moulds and a small part used in each melt. This dehydrated cupric chloride is used in about the proportion of ¼ of an ounce per 1,000 ounces of metal, and must be introduced very carefully. It is best used by putting upon surface of melt and covering with a bell mouth stirrer and gradually forcing to the bottom of the pot. The liberation of the chlorine may be perceptibly felt by the stirrer. The action of this gas is to combine with the foreign metals, which are only present in comparatively small amounts but which exert this baneful effect upon the ultimate bar. It might be well to test a bar for toughness after first treatment as sometimes a very small amount will accomplish the result sought and a good homogeneous and malleable ingot may be secured.

*Superintendent of melting and refining departments United States Mint, Philadelphia, Pa.

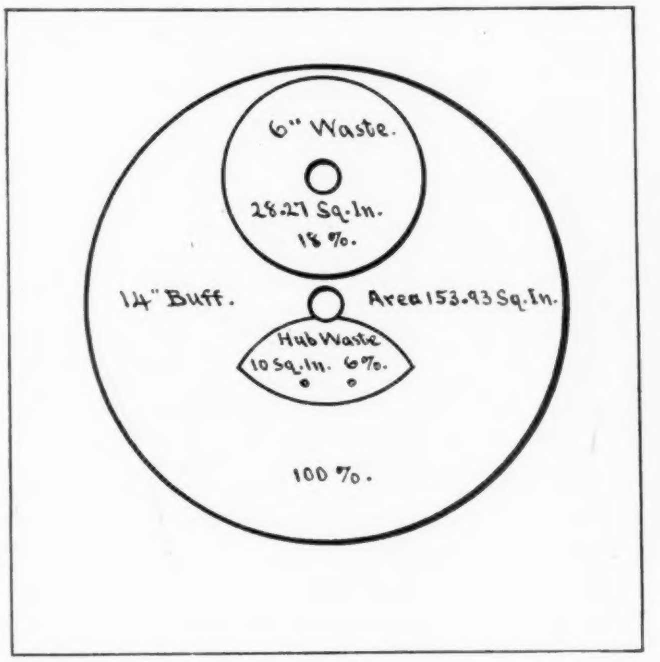
BUFFS AND DOLLARS

SOME REASONS WHY THE POLISHING ROOM SHOULD NOT BE OVERLOOKED IN THE ECONOMIC SCHEDULE OF A FACTORY.

BY FRANKLIN W. HOBBS.*

The dollars spent for buffs are too numerous to allow this particular item to be lost sight of when looking for leaks in the expense account of any polishing and plating plant. Leaky tanks are not the only roads out of these departments to the dollar burying place. In a previous article,† I called attention to the road by which dollars are led by nickel anodes to the scrap heap and buried there. I also called attention to some methods by which I have succeeded in heading them off.

In the case of buffs, the suction pipe and the furnace are the favorite channels by which they lead our friends the dollars to their last resting place, which, by the way, is "the hot place."



COMPARATIVE AREA AND PERCENTAGE ORDINARY AND HUB WASTE.

The chief object of this article is to consider the buff ends, or stubs, which vary widely under different conditions and workmen, the ordinary waste being anywhere from twelve to forty per cent. of the original cost.

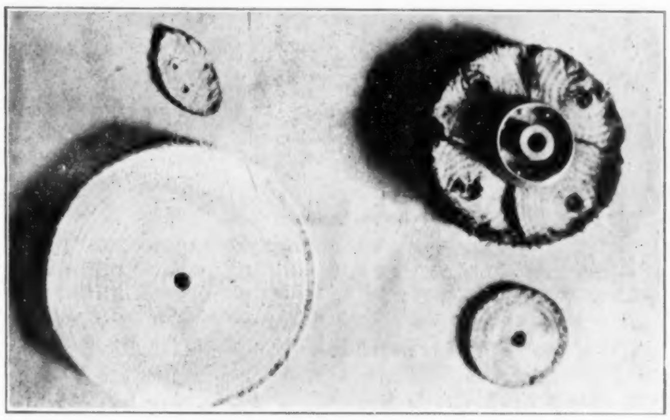
First, however, I wish to consider briefly some other phases of the buff question. There is an almost endless variety on the market, including those made from close woven or slack woven fabric, tight or slack twisted thread, light or heavy, duck, muslin, or flannel, unbleached, bleached, or inked, unstitched, full-stitched or quilted, pieced, full discs or folded, and so on. A novice perusing the various catalogs with their descriptions and claims, in an effort to select the buff best suited to any particular class of work, will have a difficult task before him.

Briefly, for rough, hard cutting down work, a full-stitched buff made from heavy close-woven duck would be most desirable, while for very soft coloring work the unstitched flannel is best. These represent the two extremes, hard and soft. The pieced variety when properly made are desirable as they wear true, therefore requiring less raking out, an item which spells economy in buff and polishing or buffing compounds.

The variety of pieced buff in which the pieces seem to be thrown down in handfulls and stitched wherever they land are pretty sure to be badly out of balance and therefore an imposition upon the buffer who is trying to save "cuss" words.

The folded or "Triplex" buff are splendid buff to work on, and the manufacturers remake the stubs. They are constructed so to form pockets which in theory hold the buffing compound and resist raveling. My experience with them does not warrant the rather high first cost and the cost of remaking.

A most important feature of buff economy is the size. The larger the buff when new the smaller the percentage of waste. To illustrate: when an eight-inch buff is worn to five inches and discarded the waste amounts to approximately thirty-eight per cent., while



14" BUFF AND ORDINARY WASTE. NIKOLAS HUB FILLED AND PARTIALLY USED AND FINAL WASTE.

with one of eighteen inches worn to six inches the waste is only about twelve per cent. It is advantageous to run buffing lathes at different speeds so that when a buff is worn down to a certain point it may be transferred to a lathe of higher speed so that the surface speed may be nearly maintained, thereby increasing the production.

Regarding the use of stubs which usually constitute the principal part of the waste, thanks to the columns of THE METAL INDUSTRY, the problem has been solved. I realize the aversion of the editor and the reading tradesmen, employer and employee, to articles which constitute free advertising. At the same time I look forward with the greatest interest from month to month to the articles which give the actual experiences of the men at the lathe and tank with the various compounds and equipment which appear on the market. Their expressions are much more valuable to me than that of those who have something to sell. Presuming that the other fellow is somewhat the same, I give my experience with the "Nikolas Hub," not for the benefit of the manufacturers thereof, but for the other fellow who is waiting for me to do the experimenting before he bites, the same as I have done in times past.

*Foreman Plater, Bangor, Me.
†Nickel Anodes and Dollars. THE METAL INDUSTRY, February, 1916.

That I am in no way in league with the manufacturers of this device the reader will no doubt believe when I say that I do not believe their assertion that it will save seventy-five dollars per year over and above its cost, if kept in constant use. The "Nikolas Hub" was announced in THE METAL INDUSTRY of April, 1915. The device appealed to me, and eight months' use have demonstrated its value, which, although not up to the claims of the manufacturers, is nevertheless sufficient to make it well worth while.

Twenty-four six-inch stubs when punched, inserted in the hib and dressed, will make a buff fourteen inches in diameter, with a face approximately the same width as a new one of eight sections. This may be worn to seven inches, the face then being so near the hub that it is practically worthless. Owing to the peculiar formation they do not gum or clog like the regular buff, and therefore require little or no raking out. Objection might be raised to its liability of catching the work, but that feature does not seem so bad in practice as one might think who had not used it.

The edges of outside layers curve back away from the work so that they do not catch. After demonstrating the value of the device I set a man to marking and punching buff stubs and tying them in bundles of twenty-four each. An accumulation of eighteen years was thus made ready for use and the average time was noted to be twenty-five minutes per twenty-four, enough for one buff. Five minutes more will fill the hub and dress it ready for use. As the six-inch stubs are practically worthless, they now cost about four mills per section for labor. The service secured is about in proportion to the area of buff consumed, which in the case of the six-inch stub is approximately eighteen square inches per section to one-hundred and fifty-four in the eighteen-inch new section, or twelve per cent. Therefore, basing our calculation on the price of twenty cents per section for the new we save two and four-tenth cents less four tenths (cost of punching and inserting), or two cents per section, neglecting the cost of hub.

In other words, by purchasing a "Nikolas Hub" (which will last a lifetime), and adding forty cents in labor to the cost of each one hundred sections of buff, at least two dollars and forty cents worth of additional service may be realized. A "Nikolas Hub" with its accompanying gauge and punch, a hammer, and a little common sense, will save many a good dollar, which should be a source of gratification to the consumer.

FOUNDRY COSTS OF BRASS CASTINGS

By W. H. PARRY*

Now that the prices of all the elements used to make brass castings are very high, it is an interesting study for concerns making and buying castings to figure up the actual foundry costs. The manufacturers of castings are certainly in a position to figure the costs accurately, though even under the most favorable conditions it is not always accomplished so that they can tell just what the castings actually cost to manufacture.

The buyer, on the other hand, is always ready to tell the manufacturer what the costs should be, but as the buyer rarely knows what he is talking about by reason of his half-baked knowledge of the founder's art, we will, for the present, eliminate him as a factor and confine ourselves to the joys experienced by the manufacturer in his often fruitless efforts to get down to brass tacks on foundry costs.

As there is now a little quarrel going on in Europe it is naturally understood that we are interested in it, if for no other reason than to use it as an object lesson to profit by, while preparing ourselves to arrive at that stage of fitness in order that we may be able to give the winner a very interesting welcome should that nation decide that we have been altogether too fresh in taking sides against them. To this end we are now becoming more conversant than ever with the metal mixtures that are used for ammunition and ordnance purposes. It is a very easy matter just now to get orders for brass castings to be made up of the 88-10 and 2 mixture, but it is not so easy to get the price per pound that such a mixture is worth.

Very recently Uncle Sam wanted a lot of rotor castings made up of the well-known 88, 10 and 2 government mixture and called for bids for same. It may surprise the readers of this magazine to know that the winner's price was actually lower than the cost of the metals that comprise the manufacture of the castings. The highest bidder's price was almost double that of the lowest and the price was rightfully so, as his method of computing the costs was based on expert foundry practice.

First, he figured the cost of the metals at the prevailing market rate for same, then his manufacturing cost, plus the overhead expenses, and then the chances of lost or bad castings, and finally added ten per cent profit and, he did not get the job.

The fatal mistake made by many brass foundrymen who bid on unfamiliar work is the omission in their calculations of that most important factor—the chances of getting bad castings. In many cases the molding cost is the most important factor of all, for if the work necessitates the use of large flasks and the weight of the castings is insignificant, then is the time to look for losses.

I personally know of a casting made a few months ago that cost eight-four cents a pound to make. This was on account of the excessive molding cost due to a poorly designed pattern which, while it was very expensively made, did not show the least trace of the possession by the patternmaker who made it of the molder's art. This also brings up another point which is very important in its bearing on the cost of castings, and that is improperly made patterns. It is usually assumed that a patternmaker has sufficient knowledge of the molder's trade to make a pattern that can be molded, but, gentle reader, not one in fifty can do so, and the two out of every hundred are not what they might be.

They can talk very glibly on how they would mold the piece if they were doing the job, and they make their patterns accordingly, but it is a safe bet that if they were given a ton of molding sand, first-class flasks and all the necessary molder's tools, they could not make a decent mold of a sash weight.

So the points to remember in estimating the costs of brass castings are the size of the order, the molding cost, your overhead, melting and cleaning costs, the kind of patterns provided and last and by no means least, the price of the metals.

*Superintendent National Meter Company, Brooklyn, N. Y.

PAST AND CURRENT PRACTICE IN MANUFACTURING JEWELRY

A Description of the Changes Made During the Year 1915-1916.

By Oscar A. Hillman.*

The jewelry factories have completed their spring sample lines and a careful comparison of the lines just out with those of other seasons indicate the splendid progress that has been made during the past year. The enormously increased cost of all raw material used has made it suicidal for any concern to try to hold its customers or increase its business by quoting special prices or making any monetary concessions to the trade. The manufacturers early realized that what jewelry is sold this year must be sold on its merits and the majority have spared no effort to reduce the making of jewelry to a science.

It would be impossible for anyone to catalogue all the heterogeneous improvements made during the past year but a brief description of a few of the changes adopted may prove of interest. The outstanding feature of the new lines is that everything heavy or large has been discarded, the result being that all the new samples are light and dainty.

The personnel of the factories have been subjected to a very thorough overhauling, the drunkards, the cigarette dopes and other classes of undesirable help having been systematically weeded out and the efficient workers promoted wherever possible. New rules for economy have thrown a larger force of good workmen on the market than can find employment and the manufacturers are in a position where they can dictate terms and use more discrimination in hiring employees.

THE STAMPING AND PRESS DEPARTMENTS

The change from the large dies from which pieces were struck with a forcer to the small dies from which the pieces are struck with a flat jack, has introduced quite a few changes in the stamping and press departments. All the dies are made from as small a piece of steel as possible so as to enable the die sinker to harden the dies almost glass hard with minimum amount of internal strain. The use of small dies and the fact that almost all gold or silver blanks are struck in polished steel collars has led to the almost universal use of vanadium or high-speed steel for dies, flat jacks, or crown-faced jack-forcers.

Where the are a number of piercings in each piece they are done on a dial press, but for very accurate work the piercing is done on a foot press, the cutter plate being equipped with a clearer and interlocking guide pins.

The high cost of stock has made it profitable to use gang tools with shippers instead of cutting blanks from single strips of stock as usual. Where the blanks are used in such small quantities that it is not feasible to make expensive gang tools the ordinary blanking cutter is used, but instead of the stock being stripped up and run through the power press single, the full width is fed in over and over, the stop clicks being so arranged that the punchings fit into each other as much as possible. It is not unusual to see heavy gauge scrap rolled down and used over for small blanks.

The use of mineral oils as a lubricant for drawing or cut-and-carry tools has always been a source of trouble and expense and during the past year a solution of Castile soap and water with all the olive oil it will hold has taken its place.

SAND BLASTING AND LAPPING

The demand for flat back, straight edge, and engraved jewelry has been the cause for the greatly increased use of sand blast machines and lap-wheel standards. The use of very fine sand with high air pressure is meeting with decided favor as the fine sand does not cause the work to curl or bend as much as when coarse sand is used. Some firms strike up very fine work in deeply cut dies and instead of doing the piercing on a press, the pieces are fitted into a chuck made of boxwood and the back turned or faced off until the piercing is accomplished.

When the pieces come from the turning lathe or face plate, the inside edges of the piercings are lined with barbs or fins. The fins are removed by fitting the pieces in the wooden chuck again and sand blasting with sand or fine emery until the edges are cut clean.

Carborundum has almost entirely superseded the use of emery for charging lap wheels and it seems to be only a matter of months before the use of emery will become a thing of the past, except, perhaps, for the very fine numbers where practically no removal of metal is required. For heavy lapping such as bevels, edges or facets the copper-lead wheels are taking the place of the antimony-lead-tin wheels, as they are not so easily scored or worn.

THE COLORING OR PLATING DEPARTMENT

There is no department in any jewelry factory to which advice, abuse, and criticism are so lavishly given as to that which is responsible for the finish of the entire output, the coloring department; so it is only natural that during a two-years' economy campaign it has been the center of the vortex and a great many sweeping changes for the better have been made.

The most important change is that the tremendous rise in price of all the chemicals used has compelled the colorer to be very sure that all the ingredients called for in a formula are indispensable, and to omit all those that are not necessary.

The plater has also learned the valuable lesson that it is invariably cheaper to make the metallic salts than to buy them. When the price of cyanide began to soar the colorers made frantic efforts to make a pound do as much as two pounds usually did. Now the majority are using sal soda in their cyanide rinse after acid dipping, phosphate of soda for a conductor in their gold solutions, hyposulphite of soda and bisulphite of carbon in their silver solutions and have substituted a weak oil of vitriol pickle for the usual cyanide dip for removing tarnish or stains. In some cases a saving of over 150 per cent. of the cyanide consumed under the old regime has been affected.

Corrosive sublimate and yellow oxide of mercury have long been considered the standard mercury salts for making the blue dip solutions, but during the past year almost all the mercury dips have been made by cutting up quicksilver in hot nitric acid and adding a small quantity to a cyanide and caustic soda solution or by making the cyanide of mercury and po-

*Electro-Chemist, Attleboro, Mass.

tassium solution with a porous cup and the electric current. The potash or caustic soda solutions and electric cleaners have been replaced by various compounds with Mineral Cleaner Kalye and the Wyandotte cleaners the prime favorites.

A dip composed of water, oil of vitriol, common salt and bichromate of potash has almost entirely taken the place of the nitric acid and water dip for removing the fire stain from sterling silver. The bichromate dip is not only very much cheaper but it does not pit or open the silver like the nitric dip. The factories that make solid gold and sterling silver have, almost without exception, installed refining rooms that are run as a branch of the coloring department, and are generally finding it a very profitable investment.

DETERMINING WEIGHT OF DEPOSIT*

Some Valuable Suggestions for the Chemical Determination of Electrolytically Deposited Metal

By L. C. Wilson.

(Continued from December.)

TESTING OF SILVER PLATED PARTS.

Coming to the testing of plated parts, the general procedure does not differ materially from the methods previously given under the other metals considered in this series and need not be described again in detail here. Nitric acid is, of course, the best solvent for silver and seems to work to better advantage when it is of about 50% strength. Paraffine may be used, as before, to protect the portions which it is desired not to have the acid attack; the exploration and locating of areas of high and low deposit may be carried out by coating the entire surface with the paraffine, then removing small areas of this at different spots, one at a time, of course, and removing the silver by immersing the part in nitric acid. The various acid portions are kept separate and the metal in each determined by some of the methods given above; dividing the weight of silver found by the area of the stripped portion in square inches gives the weight of silver deposited in grams per square inch.

If the article is of such shape that the deposition is more or less uniform all over the surface and it is desired merely to determine the weight of metal put on it will suffice to strip only one or two small areas. Naturally, if the total weight of silver deposited is required, the part, or a portion sawed from it, should be completely immersed in the acid until the plate is removed. In any of these stripping operations thorough cleaning of the surface from grease and buffing compounds hastens the action; alcohol, carbon tetrachloride or chloroform may be used for this.

Having gotten the silver in solution, its separation and determination is the next step and this may be complicated somewhat by the presence of other metals, both from the strike and from those introduced through the action of the acid on the metal of which the part is made. Thus articles of iron, brass and various alloys are silver plated, so the nitric acid solution of the silver may contain varying amounts of several metals, some of which might interfere with the analysis and need, therefore, to be removed in some way, or, what amounts to the same thing, remove the silver from their midst. Thus nickel and cobalt form colored salts with thiocyanate, which tend to obscure the endpoint. Large amounts of copper, 60% or more, are objectionable, while lead and mercury also interfere, although in an ordinary analysis they would hardly be present in sufficient amounts to cause serious trouble, consequently it will not be necessary to give the methods for separating them. It may sometimes be advisable, however, to get rid of the copper and this may be done by adding enough potassium thiocyanate to throw down all of the silver; a standard solution will not be required for this, as a small quantity of the salt dissolved in water will answer. The silver thiocyanate is then filtered off, well washed with water and transferred to a flask by poking a hole in the bottom of the filter and washing it through with concentrated nitric acid, then gently boiled for somewhat less than an hour. A small amount of sulphuric acid is formed through the breaking up of the silver thiocyanate and to avoid any possible influence which this might have on the titration some authorities recommend that it be removed by diluting to 100 c. c. and slowly adding a concentrated solution of barium nitrate until no further precipitation takes place, after which the titration with thiocyanate may be carried out as described previously.

As regards the weight of silver to be applied, it is hardly possible to consider this as definitely as in the case of some of the other metals. Silver is put on such a variety of articles, meeting so many different conditions, that the deposit varies considerably, ranging from very light coatings in certain classes of goods, where ornamentation is the main idea and there is not much wear, to the heavy deposits given to tableware and so on. It is necessary, therefore, to consider all the conditions of each case separately when deciding on the proper weight to be given.

GOLD.

Gold may well be called the aristocrat of the ordinary metals, as its refined beauty and a certain patrician aloofness, as evidenced by its lack of inclination to form entangling alliances, in other words salts and compounds, set it apart from the rest of the elements. This distinction is further emphasized by the fact that such combinations as it does enter into are, as a rule, decomposed with the greatest ease, a very moderate degree of heat alone sufficing in most cases, and the gold comes forth unscathed. It may easily be seen that such properties can be utilized to good advantage so it comes about that gold is very widely used in several lines, jewelry and ornamental work, in which the plater is most interested, constituting a large industry. One circumstance which adds to the attractiveness of gold finishes is the unusual variety of color, ranging from very light, pale yellow to rich, coppery hues, which may be obtained by proper manipulation.

As might be expected from the above, gold is generally found in the metallic, or native, state perhaps containing small amounts of other elements. It is a very heavy metal, having a specific gravity of about 19.30, and melts at 1,061.7° Centigrade; softer than silver and harder than tin, it is a good conductor of electricity, is the most malleable and ductile of all metals and is capable of being drawn into wire or

*Descriptions and illustrations of the apparatus needed to carry out the analysis described in this article are contained in an article by the same author, published in May, August and December, 1914.

beaten into sheets of extreme thinness. A sheet of gold leaf ordinarily appears green by transmitted light, but under certain conditions it changes to a deep red. On account of its high coefficient of expansion it is generally formed up by stamping, instead of molding; in the pure state it is too soft for most purposes, consequently is alloyed with silver or copper.

Air, water or sulphur gases have no effect on gold at any temperature, the pure metal consequently tarnishing but little under ordinary conditions, nor is it attacked by any of the common acids singly. The halogens, chlorine, bromine and iodine take it into solution, so the usual solvent is a mixture of nitric and hydrochloric acids in the proportion of 1 part of the former to 3 of the latter; this forms free chlorine, among other things and attacks the gold readily, the chloride being formed. Potassium cyanide and hydriodic acid also dissolve it rather slowly.

Like silver, gold is deposited almost universally from a cyanide solution and some means of obtaining a definite deposit, such as was mentioned briefly under the discussion of silver, is often employed. The determination of the amount of gold in a solution or as a deposit is not a very complicated matter and owing to the peculiar inability of the metal to form stable compounds it is comparatively easy to bring it into the metallic state, in which condition it may be weighed.

For those who possess the necessary apparatus the electrolytic method will afford an easy and convenient means of analysis since there is little manipulation connected with it. If the bath contains a good amount of metal, 25 c.c. will be enough for the determination, but if the gold content is low it will be best to work on a 50 c.c. sample. Owing to the fact that gold is most easily soluble in aqua regia, the mixture of nitric and hydrochloric acids referred to above, which also readily attacks platinum, it will be necessary to coat the platinum cone or dish heavily with copper or silver before depositing the gold, if it is desired to remove the latter afterward with acid; of course, the deposit could be backed off in a cyanide solution. The apparatus is then rinsed off, dried and weighed as usual, after which the measured amount of plating solution under test is poured into the dish, and sufficient distilled water added to bring the liquid nearly to the rim; if a cone and beaker are used, enough water to come well up on the cone should be added.

The solution is electrolyzed for two or three hours, or until the deposition of metal is complete. This point may be determined by hanging a thin strip of platinum in the solution, in contact with the cone or dish, for one half hour or so and observing if any gold deposits on it. Upon the completion of the test the cone is removed, or the dish lowered and quickly emptied, without breaking the current, then rinsed with distilled water, dried with alcohol and weighed.

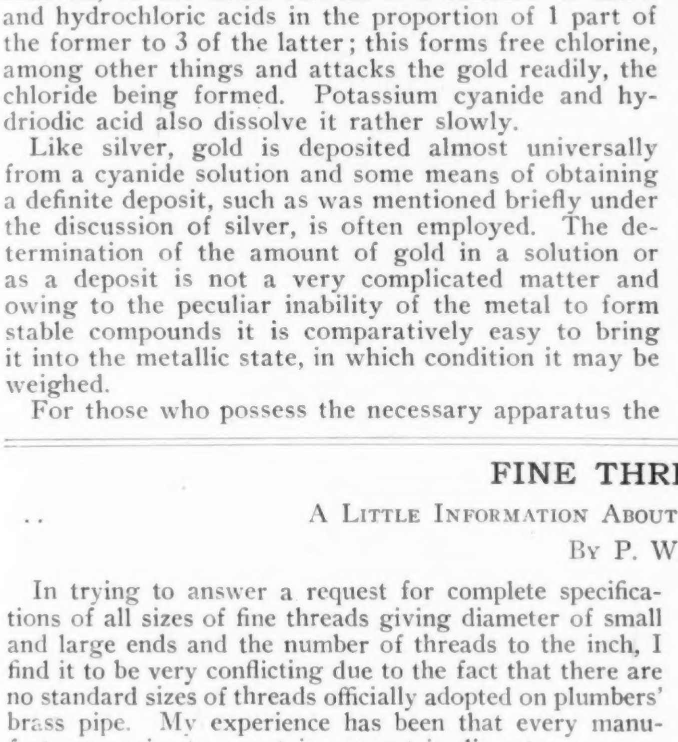
(To be continued)

FINE THREAD SIZES

A Little Information About Pipe Thread Specifications.

By P. W. Blair.*

In trying to answer a request for complete specifications of all sizes of fine threads giving diameter of small and large ends and the number of threads to the inch, I find it to be very conflicting due to the fact that there are no standard sizes of threads officially adopted on plumbers' brass pipe. My experience has been that every manufacturer varies to a certain amount in diameter.



COMPARISON OF STANDARD THREADS.

Standard gas fixture threads which are also used on sanitary traps and waste pipes are as follows:

Size. Inches.	Diameter of Thread.	Threads per Inch.
1/4	.246	27
5/16	.342	27
3/8	.390	27
7/16	.459	27
1/2	.515	27
9/16	.578	27
5/8	.637	27
3/4	.770	27
7/8	.885	27
1	1.006	27

Brass pipe threads for plumbers' brass tubing are as follows:

Size.	5/8 in.	3/4 in.	7/8 in.	1 in.
A	.662	.799	.899	1.021
B	13/32	17/32	35/64	11/16
Thread	20	20	18	18
Diam. pattern when castings used	3/4	57/64	31/32	1 7/64

This allows for shrinkage.

A table showing standard sizes and weight of plumbers' brass tubing is given below:

Size.	Exact Inside Diameter.	Exact Outside Diameter.	Weight. Brass.
5/8 inches	.521	.654	.46
3/4 "	.631	.788	.56
7/8 "	.728	.875	.67
1 "	.836	1.000	.98
1 1/4 "	1.060	1.265	1.27
1 1/2 "	1.311	1.508	1.55
1 3/4 "	1.504	1.756	1.82
2 "	1.815	2.007	2.10

It would be a good idea if the Brass Manufacturers' Association would take up this matter and adopt standard sizes the same as Briggs' Standard used for threading iron pipe and have same go into effect after a certain date. These are the official standard sizes of plumbers' brass tubing as adopted by one of the largest brass and copper pipe manufacturing plants. There are no standard thread diameters, as it seems there is a variation in those used by the different manufacturers.

*Superintendent brass finishing departments, Muller Manufacturing Company, Sarnia, Ontario, Canada.

EDITORIAL

OLD SERIES Vol. 22. No. 3

NEW YORK, MARCH, 1916.

NEW SERIES Vol. 14. No. 3

THE METAL INDUSTRY

With Which Are Incorporated
THE ALUMINUM WORLD, THE BRASS FOUNDER AND FINISHER, THE ELECTRO-PLATERS' REVIEW, COPPER AND BRASS.
Published Monthly

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CONTENTS

THE HAVOC OF WAR

We published in the February issue of THE METAL INDUSTRY a photograph of the famous bronze statue of King Arthur in the Capuchin Church at Innsbruck, Austria, with the statement that the statue had been or was to be melted down for guns by the Austrians. The statement was questioned by some of our readers, so we took up the question with the Austrian Consul General in New York and the American Press Association, from whom we had obtained the photograph. The answers we received are as follows and speak for themselves:

To THE EDITOR OF THE METAL INDUSTRY:

Answering your letter of February 16, 1916, referring to the bronze statue of King Arthur of England at Innsbruck, which was reported to be melted and molded into guns, I beg to say that this rumor is absolutely without foundation and has been officially denied by Austrian authorities.

New York February 19, 1916.

For the I. & R. Consul General:
L. VON KLEINWATH,

To THE EDITOR OF THE METAL INDUSTRY:

We acknowledge receipt of your letter of February 24 relative to the photograph of the statue of King Arthur which was purchased by you a few weeks ago.

We received the photograph in question together with another one in which was shown a half dozen or so of the statues which it was reported were to be melted down for the metal. The photographs were accompanied by a story which clearly stated that the statue of King Arthur and twenty-eight other statues at Innsbruck were to be used for making guns. We had no reasons for doubting the story as it was stated in the newspapers repeatedly in the past that all copper, bronze and other metals used in the making of arms was being requisitioned for that purpose by the Central Powers. In our opinion, the last place to have this verified would be at the German or Austrian Consulate as they for reasons of their own and in interest of the countries they represent, would naturally deny any story that hinted at a shortage of metals in their countries.

New York, February 25, 1916.

AMERICAN PRESS ASSOCIATION,
D. A. MURPHY, Photo-News Dept.

THE METAL INDUSTRY has of course no desire to raise any controversy whatsoever. The photograph was published in good faith merely to show the terrible ravages of war, which knows no regard for science or art. We sincerely hope the statue of King Arthur with its twenty-eight companion ones has been spared and will be so, that they will continue to be admired as wonderful and enduring monuments to the metal worker's art.

ELECTRO-PLATERS' BANQUET

As is told in another column of this issue of THE METAL INDUSTRY, the New York and Newark, N. J., branches of the American Electro Platers' Society held their annual banquet in New York City on Saturday, February 19, 1916.

In the complete account, as mentioned above, it will be seen that the attendance at the banquet was all that could be desired. The interest shown by the visiting

platers and their friends was equally gratifying and it would seem at first that nothing could be said that would in any way, shape or form reflect upon the management of the affair. But, as has been said some time before, "honest criticism is the best praise," and while we have nothing but words of praise for the efforts of the committee in charge of the affair, we would respectfully call their attention to some suggestions that we made in our account of the 1915 banquet in the March issue of THE METAL INDUSTRY for that year.

At that time we suggested that as the banquet was held on a Saturday that it would be entirely possible to set the dinner hour at either six or seven o'clock, thus giving five to six hours' time before midnight in which to finish the dinner and listen to the remarks of the speakers furnished for the occasion.

In spite of our well meant suggestion, the time set for the banquet on the 19th was eight o'clock, but it was fully nine before the dining room was opened. Another hour and a quarter or so was consumed in the serving of the dinner, so that by the time the first speaker was introduced out of town residents were furtively examining their watches and making mental calculations as to what time they would arrive home if they remained to hear what the speakers had to say. Also, with no attempt to cast reflections on the talent furnished by the management, we would suggest the time of each speaker be limited and strictly technical talks be barred, as a man whose stomach is full is in no fit condition to assimilate and digest solid scientific data.

We trust that the above suggestions will be accepted in the same spirit in which they are expressed, for THE METAL INDUSTRY has no desire to appear in any other role than that of an adviser.

CORRESPONDENCE AND DISCUSSION

WE CORDIALLY INVITE CRITICISMS OF ARTICLES PUBLISHED IN THE METAL INDUSTRY.

LASHED TO THE MAST

To the Editor of THE METAL INDUSTRY:

I have at last finished the most pleasurable task of looking over your January issue and I am compelled to admit that as a trade journal you have them all "lashed to the mast."

Time was, not so many years ago, when you were in your swaddling clothes we were content with anything in the shape of news of the metal industries, but now, due to your educating us to expect nothing but the best, we are always expecting that little thing from you and we have not been disappointed.

Hoping that you will always be the leader in your line,

WILLIAM H. PARRY.

Brooklyn, N. Y., January 17, 1916.

To the Editor of THE METAL INDUSTRY:

It affords me a great deal of pleasure to congratulate you upon the splendid January and February issues of THE METAL INDUSTRY.

I have been connected with THE METAL INDUSTRY in an unofficial capacity for about ten years and in those years I have watched the growth of the publication with increasing interest.

There is no doubt but that THE METAL INDUSTRY is a very important factor in the commercial life of the nation; covering the metal field in all its details as no other publication of a similar character accomplishes it.

CHARLES H. PROCTOR,
Founder, American Electro Platers' Society.

New York, February 21, 1916.

To the Editor of THE METAL INDUSTRY:

I wish to extend my congratulations to you in regard to your January issue of THE METAL INDUSTRY. It is the only technical journal that covers all branches of the metal trades. It is regarded as an authority every month by the subscribers I have come in contact with.

It also covers a wide field from an advertiser's as well as from a technical standpoint. P. W. BLAIR.

Sarnia, Ontario, Canada, February 18, 1916.

To the Editor of THE METAL INDUSTRY:

I consider your journal the most progressive and reliable of any of the electro-plating papers and shall be glad to submit any article prepared by me that seems suitable for a journal of your high standard. OSCAR HILLMAN.

Attleboro, Mass., February 7, 1916.

NEW BOOKS

The Metallography and Heat Treatment of Iron and Steel. —Second Edition. By Albert Sauveur, 7½ by 11 inches. 486 pages including index. 438 illustrations. Bound in boards. Price $6.00. Published by Sauveur and Boylston. For sale by "The Metal Industry."

While this work is devoted to the metallography of iron and steel it should prove equally valuable to the worker in other metals as the apparatus and methods of preparing samples, etc., that are employed in the examination of iron and steel are also necessary to investigations relating to brass, bronze and other alloys.

This is a fully revised and enlarged edition of Professor Sauveur's "Metallography of Iron and Steel," published in 1912. In view of the fact that a large portion of the book is devoted to the study of Heat-Treatment, the new title seems more accurately descriptive of its contents. Fifty pages of new matter and nearly one hundred new illustrations have been added in this revision. Practically every chapter has been revised to cover recent developments in the metallography of iron and steel, and the applications of theoretical considerations to industrial practice in the domain of heat treatment.

The Colorado Industrial Plan, by John D. Rockefeller, Jr.

A little booklet containing a complete copy of the plan of employees' representation—or "Industrial Constitution"—and the agreement between the company and its employees adopted at the coal and iron mines of the Colorado Fuel & Iron Company. In order that the scope and purpose of the plan may be the more clearly understood, there are also included an article entitled "Labor and Capital—Partners," reprinted from the Atlantic Monthly for January, 1916, and two addresses delivered by John D. Rockefeller, Jr., while in Colorado in October, 1915. This little book makes very interesting reading, and the progress of the Colorado plan will be watched carefully by industrial concerns all over the country. The book may be had by interested parties from John D. Rockefeller, Jr., 26 Broadway, New York.

SHOP PROBLEMS

IN THIS DEPARTMENT WE ANSWER QUESTIONS RELATING TO SHOP PRACTICE.

ASSOCIATE EDITORS: JESSE L. JONES, Metallurgical PETER W. BLAIR, Mechanical CHARLES H. PROCTOR, Plating-Chemical

ANNEALING

Q.—Would like to know the correct way of annealing nickel steel.

A.—In the annealing of nickel steel about the same temperatures are used as for carbon steel of the same carbon content. In annealing very heavy nickel steel castings of 36-inch diameter and upwards, a temperature of 40 to 50 degrees Centigrade, higher than for carbon steel castings, should be used (say about 84 degrees C.), and the soaking should be prolonged so as to get the anneal-effect through the center of the casting. Otherwise there may be an unannealed crystalline core in the center. This heavy soaking is essential and it is not unusual to see a scale ⅞ of an inch thick on a well-annealed nickel steel casting of large size.

It is customary to raise castings above the floor of the annealing furnace a few inches by means of steel blocks or bricks so that they may be heated uniformly. The increase of the heat should be gradual until the maximum is attained and when the entire mass is of uniform temperature it is allowed to cool very slowly. When a pyrometer is used it is desirable to insert the terminals of the thermo-couple into a hole drilled in the casting rather than to take the temperature of the furnace itself.

If ductility is desired care should be taken not to have the carbon and manganese too high. The following analysis gives heavy castings of excellent ductility if they are properly annealed:

Carbon	.23
Nickel	3.25
Manganese	.60
Silicon	.30
Sulphur	.030
Phosphorus	.030

With basic steel it is sometimes difficult to get solid castings without increasing the manganese and silicon to a point where ductility is reduced and annealing made difficult. By adding 10 per cent. ferro-silicon to the bath from time to time it is kept deoxidized, a more ductile steel results and the silicon may be kept below .30 per cent and the manganese below .60 per cent., when ordinarily it would need .35 to .50 per cent. silicon and .65 to .85 per cent manganese to give solid castings.

A 36-inch casting of the analysis given and annealed as described above gave the following tests:

	Tensile.	Yield Point.	Elongation 2-in.	Reduction.
Top	81,200	46,600	24.3	33.4
Bottom .	78,800	45,700	27.9	40.1

The test pieces were taken half way between the center and periphery with a hollow drill. The practice of casting coupons (test pieces) on a steel casting is worthless because nearly always the coupon will be well annealed while the casting itself is hard and crystalline.—J. L. J. Problem 2,265.

CASTING

Q.—Will you kindly let us know what there is we can use in our casting shop in the place of aluminum to make the metal run in thin castings?

A.—If you have any means at your disposal whereby you can introduce from .01 to .03 of one per cent. of phosphorous into your metal you may get better results. We would advise that the phosphorous be introduced in the form of phosphor tin, say 5 per cent. It would be necessary to have the attention of a chemist or someone who understands thoroughly the use of this material in sand cast brass in order to get the best results, as a little too much will be disastrous and cause brittle and drossy metal. This is about the only thing that we could advise to make the metal run, with the exception of aluminum, which you evidently cannot use.—K. Problem 2,266.

CONDUCTING

Q.—Kindly advise me what parts alum, glue and dextrine play in an acid copper solution.

A.—Alum in an acid copper solution combines with the free sulphuric acid and forms aluminum sulphate. This material then forms as a conducting and brightening agent for the deposit of copper.

Gelatine, dextrine and white glue are all used as brightening agents and in addition they produce a closer grained and less crystallized structure to the deposit, therefore making a more malleable and ductile metal.—C. H. P. Problem 2,267.

Q.—Will you kindly advise me why carbonate of sodium bi-carbonate of sodium, sulphate of sodium and salts of ammonium are used in brass solutions?

A.—Carbonate of sodium, bi-carbonate of sodium and sulphate of sodium are used in brass solutions as conducting and brightening agents.

Salts of ammonium, such as the chloride, carbonate and sulphate, also act as conductors, but at the same time they produce a greater reducing action upon the anode, if of brass, replenishing the solution to a greater extent with zinc than copper. The ammonium salts are therefore added to brass solutions for the purpose of bringing up the zinc in the brass alloy.—C. H. P. Problem 2,268.

FINISHING

Q.—Please give us formula and process for producing the bronze finish used on army buttons, also process for fire gilding same.

A.—The bronze finish used upon military buttons is produced by mixing red sulphide of antimony with aqua ammonia to a thin fluid paint. Then apply to the cleansed buttons with a small soft brush, afterwards dry in a lacquer oven for a short time and the color will then develop. The excess of dry antimony is brushed off and may be used afterwards again in a similar manner. The buttons should then be waxed or lacquered.

Sometimes an immersion dip is used for coloring these buttons. We would suggest the following proportions:

Water	1 gallon
Red sulphide of antimony	2 ounces
Aqua ammonia	6 ounces
Caustic potash	1 ounce

Immerse the buttons until the color develops, then wash, dry, brush and wax or lacquer.

Mercury or fire gilding is produced upon army or navy buttons by the following methods: First—The amalgam is prepared by dissolving one part of fine gold in thin strips with two parts of metallic mercury in a porcelain crucible with a bunsen flame under a good draught. The temperature should not exceed 650 to 700 degrees Fahr. Stir the mixture well with an iron or steel wire, and when the gold is dissolved and the mercury of a pasty formation pour into cold water. The amalgam should be worked with the fingers or placed in a chamois leather bag and the excess of mercury squeezed out. This mercury may be used in preparing another lot of gold amalgam.

Second—The buttons or other articles should be polished

or acid dipped and then burnished, cleansed and immersed in the preliminary dip which should consist of the following:

Water	1 gallon
Cyanide 98%	2 ounces
Chloride of mercury	1/8 to 1/4 ounce

A uniform coating of mercury should be obtained in a second or two.

Third—The gold amalgam should now be applied with a perfectly clean brass wire hand brush. The tip of the brush should be dipped in a solution of nitrate of mercury, consisting of 1 ounce of nitrate of mercury and 1 pint of water. It is advisable to place the gold amalgam upon a piece of plate glass or flat stone so that the brush can be coated by a slight pressure with the amalgam, then apply uniformly to the buttons or articles.

When enough of the buttons have been so prepared they should be fired over a bunsen or charcoal flame until the mercury is volatilized. Arrangements should be made to carry off the mercury fumes, which are poisonous. The buttons should now be cooled and scratch-brushed and if of a whitish tone reheat for a short time and while hot plunge them into a solution consisting of 1 gallon of muriatic acid and 1 gallon of water. This immersion will brighten up the gold and remove stains. The high lights may afterwards be burnished as usual.

A revolving basket may be arranged for removing the mercury in the firing operations and should be made from iron wire mesh or netting of suitable thickness.—C. H. P. Problem 2,269.

MACHINING

Q.—I am having trouble with yellow brass strainer bodies which are so hard that it costs too much to finish them. I am using ingot metal which I have had analyzed and the results of which are as follows:

Copper	69.40
Lead	2.36
Zinc	27.89
Iron	0.28

Such a small amount of iron should have no effect at 600-degree heat. I have added copper 75, lead 3 and zinc 30, and use borax and charcoal for a flux. The castings are sound and stand a high water pressure, but are too hard on tools.

A.—The yellow brass mixture is not too hard, but it is too soft, and it does not machine well because it tears when a heavy cut is taken. If you will add enough copper, tin and lead to make the mixture copper 76, tin 3, lead 3 and zinc 18, its machining and casting qualities will be very much improved. The amount of iron mentioned in the analysis ought not cause trouble if it is well distributed through the metal and thoroughly alloyed.—J. L. J. Problem 2,270.

MELTING

Q.—Can you give us any information regarding the melting of brass scrap, heat required, best method of heating, and also any other particulars? For your information would say that we have tried melting our brass scrap, but after same is poured out into ingots, find that it is too hard to roll to advantage, and as yet have not been able to find proper remedy to prevent this re-melted brass from hardening, so that it can be rolled after pouring.

A.—The best way to melt brass scrap in order to obtain good results and not getting the hard brass that you mention is to melt it in graphite crucibles with hard coal for fuel and first make a bath of copper, afterwards feeding in the scrap which should be as nearly as possible condensed in small space so as to offer as little oxidation surface as possible to the atmosphere.

The reason that brass goes hard when remelted is because it becomes oxidized and the particles of zinc oxide becoming entangled in the meshes of the metal causes the particles to become non-cohesive.

Brass may be remelted two or three times by judicious treatment and a little new stock being used each time to keep up the quality. The temperature obtained by the melted metal also plays a very important part as well as the length of time the metal is kept in the fire after being melted.

The best results to observe are practically two and are summed up as follows: Brass should be poured as near at its melting point as is consistent with the molding practice and should be poured as soon after reaching that point as possible.

If you are not using your brass metal for anything to stand air or gas pressure you might use 1 per cent of aluminum in the mixture which will cause your brass to flow more freely and be softer, but in any event you should use some new stock with your scrap for the second melting of the scrap. That is to say taking after the initial mixture, the scrap from it may be remelted once and good metal can be expected, but the third melt from the original mixture or the second remelt should have some new stock melted with it.—K. Problem 2,271.

MIXING

Q.—I would like a mixture for a white metal, one that would not tarnish easily and one that could be mixed in a crucible, poured into ingots, melted in an iron kettle and poured with a hand ladle. It will have to be strong and will be poured in iron molds.

A.—The best mixture for a white metal that does not tarnish easily and which can be poured into an iron mold is tin 92, antimony 8 and copper 2. This alloy is strong, tough and is very fluid when melted. The alloy of zinc 85, copper 10 and aluminum 5 is sometimes used for bearings. It is strong but brittle and it does not pour as well as the first mentioned alloy.—J. L. J. Problem 2,272.

PLATING

Q.—Will you advise what test (Baumé Gauge) a nickel solution should stand? The solution is used for plating plumbers' brass goods. Also amperage we should throw from our plating dynamo for a small tank of about five hundred gallons capacity.

A.—The specific gravity (Baumé) of a nickel solution made up from the usual formula of double nickel salts will register in the summer time 6½ degrees Baumé. In the winter time the best results will be obtained when they register 5½ degrees Baumé, owing to the lower temperature of the solution.

When single nickel salts are used exclusively then 10 degrees will give excellent results. The reason for this is that the solution contains a greater amount of metal and if the ammonium salts are avoided no trouble from re-crystallization will occur due to lowering temperature.

The amperage to use depends upon the surface area of the articles to be plated. A dynamo of 4 volts and 200 to 250 amperes will give ample current for two or three tanks of five hundred gallons capacity, but of course it depends upon are area of the work being plated.—C. H. P. Problem 2,273.

WAXING

Q.—We would like to cast some art pieces using the wax process and we would appreciate it if you could let us know, first, a formula for wax to be used on glue or gelatine that will not stick or melt the latter.

Second, a formula for glue and gelatine, proportions of water used, etc.

Third, a suitable composition of firebrick and plaster of paris for small and large bronze work.

A.—Three formulas according to the character of work required are:

a.		b.		c.
Beeswax	1 part	Rosin	2 parts	Ozokerite
Rosin	1 "	Ceresine	1 part	
Ceresine	1 "			

Second, soak the gelatine or glue in water until it is soft and will bend easily, then melt in a double boiler. Add water if necessary.

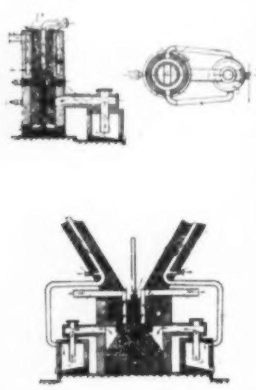
Third, high grade of fire brick reduced to dust will do, using 1 part casting plaster, 1 part fire brick and mixed with water to the thickness of cream.—W. N. N. Problem 2,274.

PATENTS

A REVIEW OF CURRENT PATENTS OF INTEREST.

1,167,998. January 11, 1916. **Process of Obtaining Metals, Such as Lead or Zinc, in an Electric Furnace.** Alois Helfenstein, of Vienna, Austria-Hungary.

This invention relates to improvements in processes for obtaining metals, such as lead or zinc, etc., in liquid form in electric distillation furnaces, as shown in cut; and the objects of the improvements are to facilitate and cheapen the obtaining of metal in liquid form, and to reduce the proportion of dust formed.

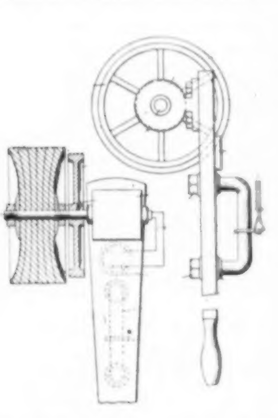


The obtaining of metals, such as lead and zinc, in vaporous form from the ore, and then condensing the vapors into a liquid, is attended by the inconvenience that substances (as for instance water and carbonic acid) are contained in the mixture, which in the heating process are carried off in gaseous or vaporous form, and partly cause a reoxidation of the metal, as are also other materials (for instance hydrogen and hydrocarbons) which partly combine with the metal vapor. These are the principal causes of the formation of metallic dust, as the impure metal does not condense in liquid form, but only precipitates as dust or powder.

The process has for its object to effect a perfect separation of the two products and consists essentially in the fact that the gases and vapors usually generated are exhausted separately from one another, before the reduction process proper takes place. This exhausting of the gases and vapors can be so effected that carbonic oxid which has already been formed is removed at the same time, so that from the very inception of the process the concentrated metallic vapors reach the condensation chamber.

1,168,189. January 11, 1916. **Polishing Machine.** W. H. Garlock, Seattle, Wash.

This invention relates to new and useful improvements in polishing machines, and has for its object the provision of a portable polisher, as shown in cut, which is adapted to be used on metallic and other signs.



Another object of the invention is the provision of a novel method of supporting the polishing wheel, in connection with the operating means therefor.

Still another object of the invention is the provision of such a device which may be easily and quickly adjusted to the person of the user and conveniently held in operative position.

What is claimed is:

A polishing machine of the character described, a support having its sides tapered from the top to the lower portion thereof, and provided with a grippling member at the lower end, a motor fixed to the wider end of the support, a buffing wheel connected on the motor shaft and arranged to be driven thereby, an independently rotatable guard wheel mounted on the motor shaft intermediate, the motor and the buffing wheel, and a U-shaped member extending through the support between the motor and the lower gripping member, to form a hand grip, said grip allowing the pressure of the buffing wheel against the article being polished to be regulated.

1,168,663. January 18, 1916. **Metal Coated Iron or Steel Article.** Clayton Mark, Jr., and Clarence Mark, of Evanston, Ill., assignors to Anson Mark and Clayton Mark, copartners as the Mark Manufacturing Company, of Chicago, Ill.

This invention consists in providing a protective coating for articles of iron or steel, and is comprised of lead, antimony and zinc in such proportions that when they are alloyed they are electropositive to iron.

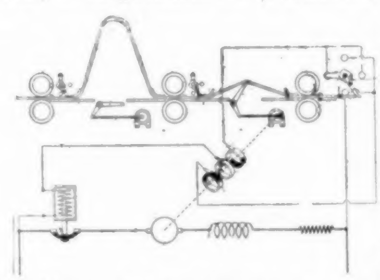
The object of the invention is to provide an alloy of coating of such a character that it will not be electronegative to iron, since in such a case a battery action is initiated between the coating and the iron at the expense of the iron and which, at the same time, will not be too electropositive to iron, for in such a case the alloy is not durable by reason of the fact that a reverse battery action ensues and destroys the coating, and when the coating has been destroyed the metal itself will become corroded.

The inventors have found it very desirable to use an alloy composed of lead, antimony and zinc, which can be applied to the metal to be protected at a temperature between 750 and 950 degs. F.

Typical examples of such an alloy are approximately as follows:

Lead	98	92	86
Zinc	1	3.5	6
Antimony	1	4.5	8

1,170,153. February 1, 1916. **Metal Rolling Machinery.** Clark T. Henderson, of Milwaukee, Wis., assignor to the Cutler-Hammer Manufacturing Company, of Milwaukee, Wis., a corporation of Wisconsin.



This invention relates to improvements in machines for rolling continuous bars or sheets of metal.

More particularly the invention pertains to automatic means for regulating or controlling the metal which is being worked upon as it passes through the rolls. In machines of this character, it is customary to pass the material through a series of rolls all, or a number thereof, working upon the material at the same time to gradually compress the same. Due to the elongation of the material during the rolling process, it obviously would be very difficult, if not impossible, to obtain such a fine speed adjustment of the various sets of rolls as to prevent buckling or crimping of the material, or else undue strain on the material between the successive rolls.

According to this invention, it is proposed to adjust the successive rolls, as shown in cut, for such relative speeds that the material will be fed out of each set of rolls faster than it will be taken up by the next succeeding set and to provide automatic means for causing the surplus material between each set of rolls to assume the form of a loop, which will obviate all danger of the same becoming crimped or buckled.

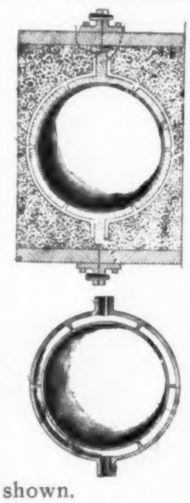
1,169,733. January 25, 1916. **Precious Metal Alloy.** R. J. Peschko, York, Pa.

This invention relates to alloys particularly designed for use as substitutes for platinum in the manufacture of jewelry, scientific instruments, dental supplies and electrical apparatus, one object being to provide alloys which while cheaper than platinum shall not be inferior to it for the purposes noted, as regards certain of their qualities. It is further desired to

provide alloys which, with possible exception of those containing from 70 to 80 per cent. of gold, shall possess a color such as will render them indistinguishable from platinum, it being particularly desired that said alloys be relatively soft, easily workable, shall possess a tensile strength higher than that of platinum, shall be capable of receiving a high polish, and shall have wearing qualities practically equal to those of platinum.

In carrying out the invention the inventor fuses together platinum, palladium and gold, and while the proportions of these metals may be considerably varied without departing from the invention, in a typical case the inventor employs, particularly for dental supplies, an alloy containing 10 parts of platinum, 30 parts of palladium and 60 parts of gold. The palladium is employed mainly for the purpose of increasing the bulk of the product for a given weight thereof as well as for the purpose of making the resulting alloy workable, and the gold is used mainly for the purpose of reducing the cost of the product.

1,170,180. February 1, 1916. **Method of Casting.** Henry W. O'Dowd, of Peekskill, N. Y., assignor to William M. Crane Company, of New York, N. Y., a corporation of New York.



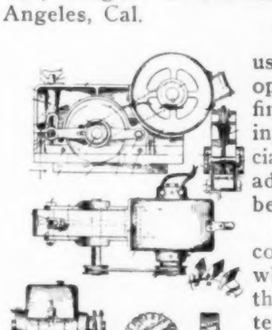
This invention relates to metal ware, and more particularly to metal receptacles, and also to the method of casting such articles.

An object of the invention is to produce a hollow metal receptacle, for example, a sphere inclosing another object, which may also be a sphere, and which receptacle may be thin and light and yet strong, durable and economical in construction.

The invention also has for an object to provide a method whereby such receptacles may be given the desired shape and dimensions and may be produced easily and cheaply.

These and other objects of the invention will in part be obvious and in part be more fully explained by the cut here shown.

1,170,454. February 1, 1916. **Portable Metal Planing and Finishing Machine.** Charles Magerkurth, of Los Angeles, Cal., assignor of one-half to Emeline Magerkurth, of Los Angeles, Cal.



This invention relates to new and useful improvements in electrically operated portable metal planing and finishing machines suitable for finishing plane surfaces of metals and especially of brass castings, though it is also adapted to operate on other material besides metal, such as wood or stone.

It is an object of the invention to construct a machine, as shown in cut, which may be moved by hand over the surface of the metal or other material to be operated on in the same manner as a flat iron is moved in every direction across the work supported on a stationary bench or work support.

Another object of the invention is to construct a machine of the kind referred to which is compact, simple of construction, positive in its operation, and having novel means for adjusting the operating tool in relation to the work, whereby a greater or smaller portion of the surface is operated on and the depth of the cut is regulated.

1,170,342. February 1, 1916. **Process for the Recovery of Metals from Waste Oils.** Mathew E. Rothberg, of Grafton, Pa., assignor to Falk Company, of Pittsburgh, Pa., a corporation of Pennsylvania.

The invention has relation to the recovery of the metals or compounds thereof, contained in the waste oils or fats or mixture of oils and fats, occurring as a by-product in the process of coating or plating metal with tin, lead, zinc and the like. In this process it is customary to use an oil, or a fat, or a combination of both, for the purpose of protecting the thin layer of metal from oxidation. A portion of these oils and fats is by the action of the metals and of heat gradually broken up into a viscous tarry compound, and into organic acids which combine with the metals, and is in the process now employed, a useless and burdensome by-product, there being no known method by which the metals contained in this waste can be profitably recovered.

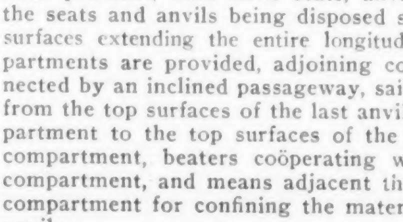
1,170,567. February 8, 1916. **Method of Producing Ornamental Surfaces.** Walter J. Smart, New York.

This invention relates to surface ornamentation, particularly as applied on articles of metal, plaster and the like, to simulate materials or substances of dissimilar natures and colorings, and especially to the production upon such objects of an ornamental surface of the popular and highly desirable finish commonly known as verd antique.

The invention is further designed to provide an economical, efficient and rapid method of ornamentating surfaces of metals which will withstand hard usage without losing its pleasing effects, and which when applied to plaster, or other materials of a like nature, as shown in cut, will render the same waterproof, making it possible to clean the plaster object as readily as one of metal. This so-called verd antique finish, as is well known, is primarily supposed to represent an old article which has been covered with verdi-gris, which by handling or rubbing has been removed from the prominent portions but remains in the crevices, thereby giving a relief and high light to the more prominent parts, and producing an ornamental effect.

1,170,888. February 8, 1916. **Metal Reducing Machine.** M. J. Fuchs, Stamford, Conn.

This invention relates to a preliminary metal reducing machine adapted for use in the manufacture of bronze powder.



The object of the invention is to provide a beating machine that will first reduce the coarse metal into thin flakes or other like proper condition for the final beaters that reduce the metal into proper commercial bronze powder.

The patent covers: A metal reducing machine, as shown in cut, comprising a plurality of longitudinally alined separate compartments, the compartments having inclined floors, the first compartment provided with an inclined inlet and the last compartment being provided with an inclined outlet, means for feeding material to the inlet, each compartment having its floor provided with anvil seats, anvils seated in said seats, the seats and anvils being disposed so that continuous anvil surfaces extending the entire longitudinal length of the compartments are provided, adjoining compartments being connected by an inclined passageway, said passageway extending from the top surfaces of the last anvils in the preceding compartment to the top surfaces of the first anvils in the next compartment, beaters coöperating with the anvils of each compartment, and means adjacent the side walls of the first compartment for confining the material being treated to the anvils.

EQUIPMENT

NEW AND USEFUL DEVICES, MACHINERY AND SUPPLIES OF INTEREST.

GLUE, ITS PROPER USE AND TREATMENT

By B. H. Divine.*

Some years ago we were called upon to design some special polishing wheels for use with an automatic machine which was widely introduced into the cutlery business, and one of the difficulties encountered in the automatic process was that of glue. This situation came about just at a time when we had been bothered a good deal with complaints that some of our polishing wheels were not working satisfactorily. An investigation disclosed the fact that the trouble was not due to the wheels, but almost entirely to two things—one the character of glue in common use and the other, and by far the most important, the methods used in handling the glue, and, as a result of our investigation, we took up the question of glue as it relates to polishing purposes and made a study of it. The writer visited glue factories and laboratories, noticing actual working conditions at every possible opportunity; had long talks with polishers and polishing foremen; got all sorts of statements and figures as to the amount of work glue produced; found out how different workmen handled glue, what their ideas were; talked with every salesman that came along; studied the characteristics of the various makes of glue so far as it was possible and came to the conclusion that what polishers didn't know about handling glue would fill a pretty good sized book. Then, we went out to see if we could have a glue produced that would combine the qualities necessary for polishing work.

The workmen handling the glue were not to blame for the condition of affairs because there was no authority in the business, no source of information, no text books and, in fact, no place for the workmen to go to for information, and each one stumbled along his own way.

It was the common practice in the polishing room for each man to doctor the glue to suit himself. The popular conception of glue was TO BOIL IT AS HARD AS THEY COULD AND AS LONG AS THEY COULD to bring out, as they frequently stated, its "STICKING QUALITIES" when, as a matter of fact, they were doing exactly the things which spoiled the glue absolutely, but they went along in blind ignorance and the proprietors of the business usually wondered why their polishing rooms cost so much to operate.

The reader should realize that the polishing room is practically the only place where glue is used where it does not lie quietly at rest, subjected to no strains after it is once applied to the articles to be glued together. For instance, in furniture, there is no strain on the furniture after it is glued together, the glue simply stays there quietly and indefinitely. In the paper box business, one of the largest consuming trades of glue, the glue is subjected to no strain at all, it is simply used as a stiffening or sizing. The same is true of the hat business and in practically every other business using glue except the polishing room.

Now when you come to consider the fact that glue is put on to a polishing wheel to hold the grains of emery or abrasive against the terrific strain of the pressure against the glue and emery of the piece of metal being polished, is it to be wondered at that the glue is blamed for a good deal, for it is simply a question whether the glue and the emery are stronger than the metal or not. If they are stronger, the metal will be removed and the polishing process accomplished; if they are weaker than the metal, the glue and emery will simply be torn from the wheel.

TWO STYLES OF THE DIVINE AUTOMATIC GLUE HEATER.

In our thirst for information, we found that people using glue day in and day out for years actually did not know what glue was, they did not know how it was made and had never been told how to use it. The glue maker takes little or no interest in the emery business, for the less he has to do with it, the more glue he sells. Formulas for "STRENGTHENING, PRESERVING AND HELPING" glue have been sold broadcast and none of them are worth the paper they are written on. The vendors of such formulas have simply played on the cupidity of the glue user. Glue has always been a mysterious thing to the polisher; he knows it is a chemical and, therefore, it is mysterious for that reason alone. No one tells him how to use it and leaves him at the mercy of his own ignorance, but we found out after some years of investigation that the handling of glue could be very easily reduced to a perfectly simple process. Like all chemicals, there is some natural fluctuation in its conditions, but not enough to

*Of Divine Brothers Company, polishing engineers, Utica, N. Y.

make any material difference in the ultimate result, when properly used.

On a recent visit to a large manufacturing plant where the writer was called in consultation, he noticed the appearance of some polishing wheels set aside to dry after being glued up and asked the engineer in charge, "What kind of glue do you use?" The engineer replied he did not know as it was some the purchasing agent had bought locally, he thought," and said, "Why what's the matter with it?" The writer replied he did not know but would like to see some of the glue. On examining the glue he perceived that it was a cheap glue consisting of two kinds, mixed and ground to disguise the mixture apparently, and after examining the same, the writer expressed the opinion that that glue was never intended for polishing work, but was put up by the makers of it, if they were reputable people, to be used in sizing paper boxes. Upon going into the stock room the box containing the glue was broken open and found it consisted of paper bags of glue evidently put up to sell at 10c. apiece, and on investigating the mark on the box the following lettering in red was disclosed:

"NO. 3 SIZING GLUE."

Then the writer went further and asked the purchaser to locate the bill for that glue and see if he didn't buy it for 12c. a pound from the local dealer, establishing the fact that the local dealer probably paid about 9c. for it and sold them a glue absolutely unfit for their work and of no more value to them than so much mucilage. The purchasing agent hunted up the bill and sure enough the local hardware store had sold it to them at 12c. a pound! Now, that's a fair sample of the intelligence displayed in the handling of glue, and is only one of a great many instances of like character we have run up against and, of course, when disclosed to the manufacturer spending the money, serves as a good basis for getting things into better shape.

The common type of glue pot in use is intended to melt up a large quantity of glue where used for purposes not involving the strength of the glue. In other words, a glue used for sizing does not have to be handled as carefully as a glue for emery work, and our researches disclosed the fact that about ninety per cent. of the trouble with glue was in the method of handling it, the lack of proper apparatus, careless conditions around the glue room, etc., and about ten per cent. in the glue itself. We have found in general that cheap glues used under fairly good conditions gave better results than higher grade glues used under poorer conditions, and a good many people who were using glue bought from the makers at from 12c. to 13c. a pound were getting just as good results as they had been able to get with glues costing from 16c. to 20c. a pound.

We started our campaign by recommending the use of better glues, but we soon found out that that would not do because of the lack of the proper apparatus to use it, so we went to work to design a glue pot, taking into consideration the conditions which must surround glue to produce good results, and we presented our design of a glue pot to a large manufacturer of glue apparatus who laughed at us and said, "It would not work." We said, "All right, perhaps it won't," and we appreciated that his point of view was exactly the same as that of the polisher. That was to say, he didn't understand the details and refinement necessary which we wished to secure FOR POLISHING WORK. After considerable trouble, we succeeded in getting the first glue heating outfit built, and we did away with the large center reservoir in common use and substituted multitudes of small units on the theory of keeping a constant supply of fresh glue on hand by continually renewing a small quantity and using up each pot full of glue before it reached the point where decomposition set in and it lost its strength.

Then, the next step was to eliminate the accumulation of old dead glue which is universally found around glue heaters, as we knew that the dead glue contaminated the fresh glue immediately upon contact with it and spoiled it, so after more research we found that aluminum contained greasy properties to a certain extent and the glue would not stick to aluminum. Therefore, instead of copper or castiron, we used aluminum for the glue pots and they automatically keep themselves clean.

Then came the question of the proper temperature of glue, and we found that glue had its greatest strength and viscosity and was in the best condition to use as an adhesive at a temperature of 140 degrees, and experiments showed that a thermometer registering 150 degrees at the bottom of the glue pot about 6 inches deep would register 140 degrees at the top of the glue pot. Therefore, we equipped our new glue heater with a thermostatic control or heat regulating device so set that it would maintain a temperature of 150 degrees at the bottom of the glue pot absolutely and all the time. We had this glue heater set up in our own shop where we had our own troubles in the use of glue of a good many different kinds in gluing up polishing wheels to resist the enormous strain of the pressure put upon them, and we immediately saw an improvement in our own work. At the end of eight months we found that we had saved enough glue to pay for the heater.

After three years' test in our plant, we decided to put this heater on the market, and it met with a very ready reception, as it took away all question as to the temperature of the glue, method of handling, etc., and then we went still further and advised the polishers of every detailed step in the handling of glue outside of the heater itself, and the results secured were truly remarkable. Reductions in cost ran as high as seventy per cent. and, in one case after five months' test, a large concern advised us that they saved eighty-five per cent. of their emery and glue.

In taking up the matter of the glue itself repeated laboratory and practical working tests of the glues in common use showed that even the high grade American hide glues did not give the results expected and desired, the general trouble being that the glues were not sufficiently flexible. They would set hard and brittle and would be rapidly torn from the polishing wheel upon contact with a sharp piece of metal, so we set about to secure a glue that had the requisite strength to hold the emery and sufficient flexibility to go and come with the yielding of the polishing wheel without being ground from the wheel.

A very exhaustive study was made of the materials from which different glues were manufactured, the policies of blending glues of different kinds, and as it developed we had to go to Europe for considerable of our information, as the writer had found in investigating European factories that the glues used over there were away ahead of American glues for polishing work and were of quite a different character. The reason seemed to be that they were made from an entirely different class of stock than American glues, many of the foreign glues being a blend of two or more different kinds of stock.

As the result of the investigation, a test was made in a large cutlery shop between a certain brand of foreign glue and one of the several high grade makes of American glue. The results showed that on an automatic machine where the human element was eliminated and the test was more accurate than hand work would have been, that wheels set up with a foreign glue had a life of thirty working days, whereas the high grade American hide glue lasted only ten days.

Investigations of glue brought to light the interesting fact that there was a great deal to glue not shown by the usual laboratory tests to determine the jelly strength and the viscosity, this difference being in the materials from which the glue was made, the uniformity of the stock used, the methods employed and, last but not least, the reliability and honesty of the glue manufacturer himself. Realizing that the supply of glue from the other side was uncertain and unsatisfactory, we hunted through the American trade until we found the proper people able to produce what we wanted. After endless laboratory tests and experiments, watching the glue we expected to market (in a good many places, comparing it with other glues as to its life, economy, etc.), we finally placed it on the market in the summer of 1915 as our STANDARD EMERY GLUE.

There is nothing peculiar about it; it is simply adapted by its natural characteristics to meet the conditions which exist in polishing work, and having the proper glue and being able to advise the users every detail step in its preparation and working, we are able, with the use of the Automatic Glue Heater, to reduce the question of glue in the polishing room to an absolute and very simple process.

Where we install both the glue and the Automatic Glue Heater it enables us to provide the operator with specific instructions for every step in the process of preparing and applying the glue, the proportion of water to the dry glue, how long to soak it, what quantities to mix up, conditions of the water used for soaking, length of time to keep the glue under heat, conditions and arrangement of the glue room, how to prepare and apply sizing, how many coats of sizing or of regular glue to use under varying kinds of work, how to dry the wheels, how long to allow the glue to set, the conditions under which the glue should set, etc.

Glue is the basic expense in the polishing business. Polishing

lathes and the wheels are fixed tools, but the glue is constantly renewed and continually replaced, and, when torn from the wheel, carries with it the emery, and according to the intelligence and care used with the GLUE, the cost of production increases or diminishes. If the glue does not stick to the wheel until the emery is CONSUMED in the work, then not only is the glue wasted but the emery also.

Emery is intended to crush under abrasive friction each particle or grain, as it crushes, carrying away with it a particle of the metal being ground or polished, but if the glue is not strong enough to hold each grain of emery, each grain is torn out WHOLE and is not crushed in the process of polishing. Every dollar spent in improving glue conditions will return a value many times in excess of the original investment.

An ideal glue room is something the writer has never seen in all his twenty-five years' of travel, either in America or Europe, but has seen many attempts to secure good conditions, but each case showed usually an attempt to correct some one of several points only, and indicated a desire to have conditions right. The reason ideal or proper glue rooms did not exist was the lack of some central authority or concentration of knowledge or place to which a manufacturer or polisher could go for accurate information. Text books on the subject do not exist and such works as have been published give only very meagre general information, whereas the polisher must have DETAILED information. He wants the whole matter explained in detail—every point concerning his particular kind of work put to him in plain, homely, every-day language that he can understand—not the phraseology of the laboratory or technical engineer.

The writer realizes that the subject covering as it does every class of metal work from grinding ploughs, snagging heavy castings and other heavy work up to the delicacy of jewellers' work, is almost beyond the ability of any one man to cover it. But many years of every-day experience on the one subject has demonstrated that it is feasible to reduce each line of work to a definite standard and that is the object of his endeavor. But view it from any angle, and all lines come to a common center, which is that practically every question in the polishing room pertaining to economy, efficiency, character of finish and everything pertaining to the polishing process as applied to the reduction of costs and finish of metals, comes down to just that thing—GLUE—ITS PROPER USE AND TREATMENT as applied to the particular use to which it is put.

THE CRUCIBLE SITUATION

BY CRUCIBLE.

The crucible manufacturers have been put to sore straits for the past eighteen months in the securing of their raw materials. First came the embargo on Ceylon plumbago (this being lifted after a few months), which left the market in a depleted condition. The natural result was a tremendous advance in price.

Next came the exhaustion of the foreign clay, which is used in crucible making as a binder. The clay used as far back as crucible history in this country goes, has come from the little principality of Klingenburg in the Black Forest in Bavaria, where, so the story goes, the entire government expenses are paid out of the export duties collected from the clays shipped out. This Klingenburg clay has for years past been the only clay the crucible makers seemed to think they could satisfactorily use. No shipments of this clay have been made since the beginning of 1915.

Some makers have husbanded the enormous supplies of the foreign clay which they had on hand when hostilities started. This husbanding the stock of the now almost priceless raw material has been done by partially substituting clays from various parts of the United States and mixing with the Klingenburg clay.

The tests and trials made by the crucible makers during the past twelve months have been almost endless. When one takes into consideration that it takes from six to ten weeks to prepare a graphite crucible for service in the foundry, some slight idea can be formed of what the crucible maker has to contend with. Added to this delay, and before he can even start in on these goods that will not be marketable for two months to come, the chemists' laboratory tests and trials must be made. These have run into the thousands. Then must come the practical tests in a small way in the foundry, for the crucible maker would stare bankruptcy in the face if he continued making up hundreds of thousands of dollars' worth of goods out of Ceylon plumbago, costing from 17½ and 25 cents per pound, only to find at the end of two or three months that they might not be of service to the user.

The bright side, however, to all that is that in many cases the crucibles made with American clays have gone a surprisingly long time in the fires. In one case there is a report on No. 300, which ran 40 heats on manganese bronze, and dozens of cases as high as 38 and 40 heats on No. 100's melting car box metal. The annoyances now seem to be the uniformity of the products secured. Crucibles made by the same potter out of similar materials, at the same time, and burned in the same kiln, when run by one melter on same grade of metals, rise and fall to a variation that is a shock to both user and maker.

All this will in time be rectified. As soon as the manufacturers have become more familiar with the mixing and blending of our native clays, they will no doubt be able to produce in time a crucible as satisfactory or superior to those manufactured heretofore. The user, however, must use more care in handling the American clay crucibles.

It is imperative that these crucibles are thoroughly dry and warm before going into the fire, and that they are heated up *very slowly* on the initial heat. Some users make a little fire with charcoal inside the crucible, and others put hot ashes in, before placing the crucible in the fire, so that the crucible is hot when it goes into the fire for the first heat. There are certain advantages in heating the crucible from the inside first rather than the outside. The melter must be very careful in the matter of wedging, as American clays have not the same tensile strength when hot as foreign clay. The advance in the prices of crucibles is due to the unusually high price of Ceylon plumbago just at present, just as with zinc, copper, aluminum, lead, etc., but as soon as the war insurances are a thing of the past, then plumbago will be at a normal figure once more and crucibles will again be marketed at as low or lower prices than they have been for many years past.

CYANIDE STANDARDIZATION

The Roessler and Hasslacher Chemical Company, New York, N. Y., beginning January 1, 1916, changed the designations of their various grades of cyanide, basing same on sodium cyanide contents. Owing to its lower cost, sodium cyanide has now entirely replaced potassium cyanide in the recovery of precious metals, in fumigation, plating, etc., the results being equal if not superior to those attained by the use of potassium cyanide. The lower cost of transportation is also an element of saving because of the greater cyanogen content of pure sodium cyanide.

Old Designation.		Cyanogen Content. For Both.	New Designation.	
Carbonate mixture	58-60%	51-52%	Sodium cyanide	96-98%
Sodium cyanide	129%		Cyanide chloride mixture	73-76%
Cyanide chloride mixture	98-99%		Cyanide chloride—	
Cyanide chloride—		11-12%	Carbonate mixture No. 1.	
Carbonate mixture	28-30%		Cyanide chloride—	
Cyanide chloride—		15-16%	Carbonate mixture No. 2.	
Carbonate mixture	38.40%		Cyanide chloride—	
Cyanide chloride—		19-20%	Carbonate mixture No. 3.	
Carbonate mixture	48-50%		Cyanide chloride—	
Cyanide chloride—		23-24%	Carbonate mixture No. 4.	

ASSOCIATIONS AND SOCIETIES

REPORTS OF THE CURRENT PROCEEDINGS OF THE VARIOUS ORGANIZATIONS.

ELECTRO-PLATERS' BANQUET

New York Branch Members Entertain Themselves and Their Friends at a Get-Together Dinner in New York City.

The New York branch of the American Electro-Platers' Society to the number of two hundred and twenty-two, enjoyed its seventh annual banquet at the Broadway Central Hotel, New York City, February 19, 1916.

The reception committee consisted of the following: Messrs. H. C. Flanigan, chairman; C. Frey, B. Popper, W. J. Smart, O. C. Moller, C. H. Buchanan, C. Ditmar, De Baum and C. H. Proctor.

The association kept open house at the hotel from one o'clock until after midnight. During the entire afternoon and early evening platers were coming from all parts of the country to renew old acquaintances and to exchange views on plating and kindred subjects. In order to show the wide field from which the occasion drew its attendance it is only necessary to mention that "Dick" Sliter came all the way from Cleveland, Ohio, in order to meet with W. E. Simmons, of Lowell, Mass., while letters of regret were presented from Joseph Walters, of Richmond, Va., and Supreme President Barrows, of Toronto, Canada, who is down in Florida.

In connection with the banquet which was an evening affair, there was held an exhibit of platers' supplies and appliances. The committee of arrangement, of which William J. Schneider was chairman, deserves a great deal of praise for the successful carrying out of its plans, and to Charles Buchanan is due great credit for his clever work in securing exhibits. The banquet committee consisted of the following: Messrs. William J. Schneider, chairman; William Fischer, secretary; Thomas Haddow, Marshall E. Stewart, William Voss, G. J. Weigand, H. Miller, W. R. Shanks, J. Minges, J. A. Stremel and W. Betz.

In a room on the second floor of the hotel devoted for that purpose various collections of plating apparatus and supplies were arranged in simple fashion so that they could be closely inspected and their various features explained and pointed out by the attendants. These exhibits and exhibitors were as follows: E. Reed Burns, Brooklyn, N. Y., had an extensive exhibit consisting of a board carrying an electric bus bar, anodes and connections and various styles of anode clamps. There was also an extensive array of sewed canvas polishing wheels and a line of polishing compounds.

The Eureka Pneumatic Spray Company, New York, N. Y., had an exhibit of their line of sprayers and samples of work done by means of these sprayers. This company also exhibited a recent patent which covers a method of producing ornamental surfaces. The company has announced its intention, as is told in another column of this issue of The Metal Industry, of fully protecting itself under the terms of this patent and for a nominal sum will grant shop licenses for the full term of the patent.

C. Upham Ely, 60 Vesey street, New York, N. Y., had an exhibit of the Crown Rheostat for which he is the agent and also several forms of nickel anodes both of the regular composition and 99 per cent. pure. He also exhibited volt and ammeters, rouges, tripoli, crocus composition, nickel finish, cyanides and banner lye.

The U. S. Electro-Galvanizing Company, 1-9 Park avenue, Brooklyn, N. Y., exhibited a model of their U. S. Junior plating barrel. P. Mahler & Sons, 299 Pearl street, New York City, had an exhibit of machine and circular brushes for silversmiths, silver and nickel platers use, also brass and steel wire brushes of all descriptions. G. J. Wiegand, of the Auto Pneumatic Action Company, New York City, had an interesting exhibit of die castings plated with brass, nickel and copper.

At eight o'clock the busy platers took themselves to the main dining room on the first floor of the hotel and after the flash light photograph, which is shown on another page of this issue of The Metal Industry, had been taken they got busy and polished off the various items of an eccentric menu. This important part of the banquet having been completed the audience settled themselves and listened to the remarks of the various speakers who were ably and simply introduced by Toastmaster E. W. T. Faint, president of the Newark Branch. The speakers were as follows: Dr. Blum, detailed by the Bureau of Standards, Washington, D. C., to explain to the platers what the Bureau is doing for electro-plating, talked for nearly an hour on this subject. We publish an abstract of Dr. Blum's speech on another page of this issue of The Metal Industry.

Dr. Hiram S. Lukens, professor of Chemistry, University of Pennsylvania, Philadelphia, Pa., followed Dr. Blum and told considerable relating to the analysis of plating solutions.

Following Dr. Lukens came Dr. W. App Jones, of the Celluloid Zapon Company, New York, who explained briefly the effect of the war on the chemical industry in this country, and he told some interesting facts relating to the attempts being made here to manufacture various chemicals which heretofore had been imported.

After Dr. Jones had finished, Dr. F. C. Stanley, of the Bridgeport Branch, and professor of chemistry at the Brideport High School, Bridgeport, Conn., told the diners of his work in advancing the study of chemistry by the Bridgeport platers.

A number of telegrams of felicitations and regret were read by the chairman of the banquet committee, William J. Schneider. One of these was signed by the Supreme Secretary of the Association, Walter Fraine, and conveyed the best wishes of the Supreme Society. Another was from founder Charles H. Proctor, who from a far distant city expressed his regret at not being able to be present and officiate as toastmaster as had been planned. At this point it was announced that President Barrows, of the Supreme Society of Toronto, Canada, had gone south because of ill health and therefore a standing vote was taken to extend to the President sympathy and best wishes for a rapid recovery.

The banquet then came to a close at a late hour. Among the souvenirs distributed at the banquet was a handsome pocket pencil from the Celluloid Zapon Company of New York, N. Y. An enamel button bearing on its surface a design of a shield in red, white and blue; having on its top edge the words "Uncle Sam Always" and at the bottom "E. P. S. Co." was given by the Eureka Pneumatic Spray Company of New York, N. Y. The menu was furnished by the J. B. Ford Company of Wyandotte, Mich., and cigars by the Egyptian Lacquer Co. of New York.

THE NEW YORK BRANCH OF THE AMERICAN ELECTRO-PLATERS' SOCIETY AT THEIR SEVENTH ANNUAL BANQUET, AT GRAND CENTRAL HOTEL, N. Y., SATURDAY, FEB. 19, 1916.

THE WORK OF THE BUREAU OF STANDARDS AND ITS RELATION TO THE ELECTRO-PLATING INDUSTRIES*

By William Blum.†

In a recent report of the director of this Bureau, the standards with which this institution has to deal have been classified as follows: Standards of measurement, standard values of constants, standards of quality, standards of performance, and standards of practice. Examples of these various classes are as follows:

Standards of measurement include standards of length, weight, capacity, temperature and light. Among the physical constants studied at the Bureau may be mentioned atomic weights, electro-chemical equivalents, and latent and specific heats. Standards of quality are involved in the specifications for and testing of materials, such as steel, paint, oil, cement, paper and cloth. While such work is done by the Bureau of Standards principally in connection with Government purchases of supplies, the results are often of great value to the manufacturers of such materials, and through them to the general purchasing public.

Standards of performance are involved in tests upon the efficiency of various engineering and measuring instruments, including all classes of meters. Frequently these studies have led to improvements in the design of such instruments.

Standards of practice have been studied with special reference to those operations of general public interest, such as the regulation of public utilities. However, where in certain industries there is a recognized need for information that cannot be secured through existing commercial agencies, the Bureau is glad to furnish such assistance as its force and facilities permit.

In general it "may be said that the Bureau occupies somewhat the same position with respect to the manufacturing interests of this country that the bureaus of the Department of Agriculture do to the agricultural interests." The Bureau, in its various classes of testing work, does not compete with private testing laboratories, but endeavors to assist and supplement their work.

While numerous inquiries have been received by this Bureau on questions relating to electro-plating, some of which we were able to answer, no investigations have thus far been carried on with special reference to the needs of electro-platers. However, through requests for information from Government bureaus, and subsequently through the co-operation of the International Association of Electrotypers, some investigations have been conducted in the closely related field of electrotyping. An account of this work may be of some interest to electro-platers, as at least illustrating the kind of information which may be secured by this Bureau so far as its force and facilities permit.

The principal bath in use in the electro-typing industry is the simple acid copper sulphate bath, which has, therefore, formed the basis of most of the work done by us in this field. The important researches completed, or now under way, are upon (a) the specific gravity of copper sulphate-sulphuric acid solutions, (b) the conductivity of such solutions, and (c) the effect of composition of solution, temperature, current density and agitation upon the structure and properties of the deposited copper.

In the study of the specific gravity of these solutions, it was found that this property depends upon the total content of copper sulphate plus sulphuric acid, being nearly independent of their proportion. Thus a solution containing 150 grams of copper sulphate and 100 grams of sulphuric acid per kilogram of solution has a specific gravity at 25°/40° C. of 1.174, while one containing 200 grams of copper sulphate and 50 grams of sulphuric acid per kilogram has a specific gravity of 1.175. From a determination of the specific gravity and the content of free acid, as described in the first edition of Circular 52 (The Metal Industry, January, 1916); using the tables to be published in the next edition of Circular 52, it is a simple matter to determine and correct the composition of such solutions.

*Abstract of an address at the banquet of the Electro-Platers' Society, New York City, February 19, 1916.

†Bureau of Standards, Washington, D. C.

The conductivity measurements, not yet completed, will be of value in determining the relative power efficiency of baths of different composition. In the experiments upon the electro-deposition of copper, conducted at the Royal Electrotype Company of Philadelphia, the copper was deposited upon graphited wax molds, under commercial, but strictly defined conditions. The resultant copper "shells," which were about 0.2 mm. (0.008 inch) in thickness, were then tested at the Bureau of Standards, the following properties being determined, viz., ultimate tensile strength, permanent elongation after fracture, average thickness, distribution of the copper upon different parts of the form (plain, half-tone, type and rule work), and microstructure, both before and after annealing. This work has not yet been entirely completed, especially certain tests upon the hardness, as measured by resistance to penetration and to abrasion; the relations between the microstructure and the other physical properties; and finally service tests of copper of known structure and physical properties. (The methods of study employed in this work, and the properties and structure of the copper deposits, were illustrated by means of specimens and photographs. The latter will be included in the publication of the completed work, which will be issued as a technologic paper of the Bureau of Standards. Notice of its publication will appear in the technical journals.)

From the work thus far accomplished, the following conclusions have been reached, some of which have been published as a supplement to Circular 52. (The Metal Industry, January, 1916.)

NICKEL ELECTROTYPING SOLUTIONS.

Although this Bureau has made numerous observations upon the composition and operation of commercial nickel electrotyping solutions, it is not yet prepared to make specific recommendations concerning them. To do so will require an extensive study of the numerous problems of both nickel-typing and nickel-plating. In fact, the production of nickel electrotypes, especially upon wax forms, is in some respects a more difficult operation than nickel-plating, since cracking and curling are much more likely to occur in the former case. The whole subject of the best composition of nickel solutions and anodes, and the operation of the baths is greatly in need of study, which will be conducted as rapidly as facilities permit. In connection with such a study, it is hoped to make some tests upon *cobalt* plating, and especially *cobalt electrotyping*, in which very promising results have been obtained. In the meantime we will be pleased to answer, so far a spossible, any inquiries in this connection.

PUBLICATIONS.

The only Bureau publication in this field at present is Circular 52, on the "Regulation of Electrotyping Solutions" (The Metal Industry, January, 1916). The first edition is confined to simple directions for testing the solutions, and is chiefly of interest to electrotypers. In the second edition, now in course of preparation, numerous tables and definitions will be included, of interest to both electro-platers and electrotypers. The scope of the new edition may be illustrated by the following condensed table of contents:

Outline of the electrotyping industry; scope of the investigations in this field; methods of expressing temperature, density and composition of solutions; definitions of electrical terms and their application to electro-deposition; the factors affecting the deposition of copper from acid sulphate solutions; tables showing the relations between Centigrade and Fahrenheit temperatures; specific gravity, and degrees Baumé; and metric and customary units; a table of the specific gravity of solutions of given content of copper sulphate and sulphuric acid; and tables giving in metric and customary units, the calculated weight and thickness of copper deposited in a specified time with a given current, and conversely the time required to produce with a given current deposits of specified thickness. It is hoped to have this new edition ready for distribution in a couple of months from

now. Notices will be published in the technical journals as soon as it is available.

While the work thus far accomplished by us in this field has been of only incidental interest to electro-platers, the plans for this work involve a study of their specific problems whenever adequate force and facilities for such work can be obtained. In the meantime we will be pleased to answer, so far as possible, inquiries in this field, and to receive suggestions as to the nature and importance of the problems in need of study.

FOUNDRY AND MACHINE EXHIBITION

C. E. Hoyt, of Chicago, formerly secretary of the Exhibition Company, has been appointed manager of the exhibit of foundry equipment and supplies, which will be conducted under the auspices of the American Foundrymen's Association and the American Institute of Metals, concurrent with the conventions of these two organizations at Cleveland, during the week of September 11, 1916. Mr. Hoyt has had a wide experience in exhibition work, having had an active part in the conduct of foundry shows at Cincinnati, Detroit, Pittsburgh, Buffalo and Chicago.

The exhibition is in charge of a committee of eight, composed jointly of representatives of the American Foundrymen's Association and the exhibitors. This committee is constituted as follows: B. A. Bull, chairman, president of the American Foundrymen's Association, Commonwealth Steel Company, Granite City, Ill.; Major Jos. T. Speer, past president of the American Foundrymen's Association, Pittsburgh Valve Foundry & Construction Company, Pittsburgh, Pa.; Alfred E. Howell, past president of the American Foundrymen's Association, Phillips & Buttorff Manufacturing Company, Nashville, Tenn.; J. P. Pero, senior vice-president, the American Foundrymen's Association, Missouri Malleable Iron Company, East St. Louis, Ill.; A. O. Backert, secretary of the American Foundrymen's Association, Cleveland, Ohio; S. T. Johnston, S. Obermayer Company, Chicago, Ill.; V. E. Minich, Sand Mixing Machine Company, New York City, and H. S. Covey, Cleveland Pneumatic Tool Company, Cleveland, Ohio.

The exhibition will be held at the Cleveland Coliseum,* which has an available floor area, on one level, of 60,000 square feet, which is located within one block of the Hotel Statler where the meetings of the American Foundrymen's Association and the American Institute of Metals will be held. It has been decided to charge the same prices for floor space as has prevailed heretofore. Although no floor plan of the building has yet been prepared, a large number of applications for space already have been received and the indications are that the Coliseum will be inadequate to provide for all of the exhibits, necessitating the erection of a temporary building on an adjoining lot. At a recent meeting of the executive board of the American Foundrymen's Association it was decided to incorporate and this will be effected in the near future.

*A photo was shown in THE METAL INDUSTRY, January, 1916.

TRADE NEWS

BUSINESS REPORTS OF THE METAL INDUSTRY CORRESPONDENTS.

WATERBURY, CONN.

MARCH 6, 1916.

Two large problems which have confronted business men in the Naugatuck Valley are looming particularly large just now—the labor problem and the shipping problem—but aside from these features business is splendid and prospects for continued high speed prosperity reassuring.

During the past two months the annual meetings of the various corporations have been held and at all of them there were such reports as the stockholders never heard before and records of earnings indicative of shrewd management and careful financing, although wages and salaries had been raised beyond all forecasts and materials had been more costly.

At present the metal industries, particularly the brass industries, are running at full speed and have ample orders ahead, both of staple and special goods, and there is no break in the outlook which indicates any but continuous pressure for local production. Even the war clouds that are built in some imaginations and occasionally reflected in press reports have little threat for local industries, for it is anticipated that, should this country be drawn into any conflict there would be immediate speeding up of local industries.

But the labor problem is annoying, to say the least. There are difficulties in almost every plant. At the Scovill Manufacturing Company's plant there is an unceasing demand for help. The profits of the company have been so large that it has been paying a five per cent. bonus every month since November and this month it paid a ten per cent. monthly bonus. In addition, of course, it has paid an extra dividend of five per cent. every month to its stockholders. Other companies have advanced their wage schedules regularly, but still there is a migration toward the Scovill works that is hard to check and which affects all departments of some of the larger plants. Even industries which have not experienced any such boom as the plants which supply the munition makers with materials have had to make changes. Limits have been removed in those shops where there were maximum allowances on piece work and in many now "the sky is the limit." When women and girls can draw down between $12 and $18 a week on a fifty-hour schedule and collect a five per cent. bonus besides, every month, they are not fussy about the charms of any particular plant where the rate is materially less. The men were always that way, and because of unprecedented conditions in some of the larger industries here the local wage scale has been forced higher than in most other towns in New England and it seems bound to be higher for some time to come.

Then the shipping problem looms larger and larger. This section of the country is wholly dependent on the New Haven railroad's facilities. These are poor enough, but when there is a rush inward of freight and there are embargo orders glaring at one from every side, the situation is discouraging. The manufacturers were yanked up short a few weeks ago by an embargo order which threatened to make much trouble because it blocked the passage of raw materials. There were prolonged sessions with the railroad heads and the Chamber of Commerce of Waterbury and the Manufacturers' Association of Connecticut set on foot a plan of co-operation which brought about prompt relief. Orders were issued from one office to close a mill, if necessary, but unload cars as fast as they arrived. Now there is a relapse to the old condition and a general embargo has been placed on all but perishable foods. Some factories will have to ship some materials by express, as they have been doing, at great cost, for more time, but most of the local plants have stocked up enough on raw material to be safe. The embargo is a hardship and unless it is promptly lifted it will mean much more than temporary annoyance to Connecticut industries. It has forced into consideration the use of freight hauling automobiles from New York to these parts and it has been exasperating enough to set Naugatuck valley men thinking of the possibilities of independent rail freight lines.

Orders are plentiful in all lines. The recent freight embargo orders have forced buyers to place their requisitions for from six months to a year ahead and there is hardly a plant that can see short time ahead this side of 1917. Collections have improved since the beginning of the year.—F. B. F.

ANSONIA, CONN.

MARCH 6, 1916.

After a strike lasting about ten days the laborers at the Ansonia plant of the American Brass Company returned to work

Monday morning, February 28. They compromised with the company Saturday on a fifteen per cent. increase in wages. They had demanded twenty per cent. increase when they struck. The company offered ten. The strike continued for over a week after this offer had been made and finally the strikers accepted the fifteen per cent. compromise offer. The same increase went into effect in all plants of the American Brass Company.

Ansonia has had strikes of more or less importance for some time and there have been threats of trouble at the American Brass plant occasionally, but nothing happened until a small gang of Industrial Workers of the World came in here in February and worked up the laborers. They apparently won little sympathy with the English and German speaking elements, but among the other alien laborers their doctrines found favor. The strike spread among the men rapidly and the plants were shut down the second day, though some four hundred guards were put on duty as watchmen and special police, in charge of the foremen. The strikers found difficulty in making the company understand their demands for there were ten languages spoken among them and every spokesman seemed to doubt what the other fellow was saying. A young man, Joseph Grohol, who understood seven of their languages, and happened to be the owner of their meeting place, interfered at an early meeting, threw an I. W. W. worker off the stage and took the leadership of the strikers, although not a factory workman, nor a resident of the town himself. He has been the spokesman for them since and through his influence the peace of the community was preserved. Not long ago he was out of a job and recently he has been a stock actor. He happened to be in Ansonia settling up his father's estate, the funeral having occurred a few weeks ago. The I. W. W. workers have left town.

There is a much better feeling in Ansonia than before the strike and peace is expected to prevail in all plants soon. The worst difficulties have been among the toolmakers, as in Bridgeport and other communities.—F. B. F.

HARTFORD, CONN.

March 6, 1916.

Labor leaders have declared that the agitation for an eight-hour working day in Hartford factories, which was a failure last fall, will be renewed with vigor before April 1. Thomas Kelley, manager of the local bureau of the Manufacturers' Association of Hartford County, has replied that the eight-hour day in Hartford is an economic and industrial impossibility, that the workingmen of the city have come to realize this, and will not be misled. The contrary attitudes assumed by the manufacturers and laborers indicate that the prosperity which Hartford has enjoyed since shortly after the beginning of the European war, by reason of the congestion of orders in the local metal industries, may suffer a severe blow in the spring. At present, however, the majority of the metal industries are operating overtime, as has been the case for several months.

The Pratt & Whitney Manufacturing Company has awarded a contract for a large new factory building. The building will be an addition to the plant of the company on Capitol avenue, will be four stories and a basement, of brick and steel, modern factory construction, and will cost $75,000. The building will be 108 by 60 feet. Work will be started right away, and it is expected a record will be made in the speed of the erection of the building, as the company has urgent need of it.

The thirteenth annual meeting of the Connecticut Hardware Association was held in Hartford February 23 and 24. The following officers were elected: President, H. W. Morse, Meriden; vice-president, W. B. Richards, South Manchester; W. B. Hotchkiss, Waterbury; recording secretary, Henry L. Hitchcock, Woodbury; financial secretary, Harry G. White, Bristol; treasurer, E. G. Seaman, South Manchester.—T. C.

NEW BRITAIN, CONN.

March 6, 1916.

That the ardor of the local union men who figured in the big manufacturing strike in this city last fall has not been dampened by the outcome of their efforts on that occasion, has been evidenced by an announcement from one of the leaders that beginning March 2 a series of open meetings will be held here to stimulate interest. While the union men in the factory are reticent over their plans for the spring, their latest move gives rise to the report heard frequently that a demand may be made on the manufacturers for recognition of the union and the adoption of the scale of wages as in force in factories which conduct closed shops. Thus, while from a business standpoint everything indicates a prosperous spring, as orders are already coming into the offices in gratifying numbers in anticipation of the spring trade, yet the manufacturers' viewpoint is not as pleasant as it might be in view of the apparent possibility of another crippling strike.

Business at present is very good and everything points to a continuation of this era of prosperity here. All of the factories are working ten hours a day and some are working more than that. At the P. & F. Corbin branch of the American Hardware Corporation business is rushing. As evidence of the business that is being done here is a statement that a big Pacific coast wholesaler has ordered twelve hundred dozen locks for immediate delivery. The factory had but five dozen on stock. Orders such as this make it apparent that business is good. The Stanley Works is also doing a remarkable business and during the past year the company surplus has been increased from $255,000 to $414,000. At the recent annual meeting of the Stanley Works, favorable action was taken on the charter amendments which will permit the company to issue additional capital stock whenever the stockholders so vote and to purchase stock from the market for the employes and if desired to aid the employes to finance the purchase of stock. The old board of directors were all re-elected.

Dividends of over a half a million dollars were paid by the American Hardware Corporation during the past year, as is shown by the fourteenth annual statement of that concern. The figures for the year are: Gross profits, $1,044,825.10; depreciation and reserves, $376,789.24; thus leaving $668,035.86. Dividends paid totaled $592,200 and $72,835.86 was added to the surplus.

Landers, Frary & Clark is doing a prosperous cutlery business and at the recent annual meeting all of the directors were re-elected. The directors subsequently re-elected the old officers with Charles F. Smith as president and treasurer.

The National Spring Bed Company has also held its annual meeting where it was shown that the company is doing a good business and the stock has again been put on a dividend basis, a 1¼ dividend having been declared. At this meeting Otto Burckhardt was chosen treasurer to succeed the late Frank J. Porter. Mr. Burckhardt in 1898 became a clerk in this office and by faithful work advanced himself to his present position. He will combine the offices of secretary and treasurer. J. H. Minor is president; and F. A. Wright is the new sales manager who comes here from Boston, where he has been in charge of the office.

Other metal manufacturing concerns are all feeling the throb of increased business and look forward to a successful season.

H. R. J.

PROVIDENCE, R. I.

March 6, 1916.

There has been a noticeable activity, even for this unusually active period, among the numerous concerns—large and small—throughout Rhode Island engaged in the metal trades. The machinery manufacturers are in an especially good condition at present, and a majority of them have orders enough on hand to carry through the entire year, and in many cases beyond the first of 1917. There are many of the shipments that are being sent away constantly, going to almost every country in the world. Never before in the industrial history of Rhode Island have the products of its metal plants been so universally and widely distributed. One firm shipped to more than thirty different countries during six days recently.

There is still a shortage of help here and the supply that is coming forward has not been trained to take positions at the machines in the plants and operate with any degree of success or speed. War munitions form a large portion of the work on hand, as has been the case for the past year. The orders from domestic sources, however, are keeping their end up and are returning a good profit according to the manufacturers. The foundries, small tool manufacturers and brass workers are also reporting good business; in fact, some of these plants are being rushed to the limit of capacity, but

could start another shift if sufficient employes could be secured.

The jewelry manufacturers, who suffered such a long period of depression during 1915, still find considerable business in the returns which they are receiving from their representatives on the road especially through the middle west, to encourage them. While there is nothing resembling or indicating a business boom, there is a steady and constant supply of orders on hand or coming in that will keep a majority of the manufacturing plants working well up to their capacity for some time to come. The fact that hundreds of the former jewelry workers are now engaged in some other line of industry filling positions that they obtained during the recent long depression, caused, and is causing, some trouble and inconvenience in the factories. This has made it necessary to take on green hands and teach them the rudiments of the business. The greatest problem that is being faced by the manufacturing industry, however, at the present time is that in connection with the increasing cost of materials of all kinds. When the end will be reached in this connection is not being predicted even by the wisest of the plant owners, and there appears to be no solution other than to pay the prices that are demanded by the supply houses.

Business at the plant of the Standard Nut and Bolt Company, Valley Falls, R. I., is booming and more orders for the product of the plant have been received than can be filled for the next several months.

John A. Taudvin has been elected president of the Pawtucket Screw Company, the other officers elected at the recent annual meeting of the stockholders being as follows: Vice-president, George W. Hill; secretary-treasurer, Orris C. Hill; board of directors, the three officers named and Archibald Birtwell and Wilbur Beach. The company has declared its regular dividend of seven per cent.

The Sanderson Manufacturing Company, which began business some months ago at Pawtucket, R. I., manufacturing mesh bags and parts, has recently been extending its business and is now manufacturing button shanks, brass spring rings and other findings.

The annual meeting of the stockholders of the Nicholson File Company was held recently and the directors chosen for the ensuing year, after which the directors organized and elected officers. Col. Samuel M. Nicholson, the president, in his annual report, said that despite the adverse conditions for the first nine or ten months of the year, the demand now was greater than the supply and the company showed earnings in excess of the dividend requirements.

The industrial boom in this city seems to have about reached its height, but there is nothing to indicate any waning movement. Big corporations are operating not only at full capacity, but many are doing better than ever before. Skilled workmen can secure positions at any time, and unskilled workmen, who want employment, can find it without serious trouble. All lines of industry are busy and the signs a few months ago "No help wanted" are now replaced by the sign "Experienced workers wanted."

The Brown & Sharpe Manufacturing Company is employing between 5,500 and 5,600 hands. The American Locomotive Company, which a few months ago was closed, is now employing 1,200 hands and the Gorham Manufacturing Company is employing 2,100 hands, all that can be handled with the present facilities, although a new addition is being erected that will afford accommodations for another 400, to be ready in about a fortnight.—W. H. M.

ATTLEBORO, MASS.

March 6, 1916.

Business in the shops in the Attleboros continues to hold up although a few are working on short time, a condition which has not been unexpected! Many firms are greatly handicapped by the inability to get chemicals and stones for their work. The prices on these materials have made such rapid advances that they are now almost prohibitive. Some chemicals essential to several lines of jewely work are completely off the market and as a result several shops have been compelled to cancel large orders.

Plans have been practically completed for the removal of the Bugbee and Niles Company of Providence to North Attleboro. This firm employs about 60 hands and has enjoyed a prosperous business during the past few years and will be a welcome addition to the jewelry industry in North Attleboro. Alpin Chisholm, president of the Bugbee and Niles Co., is a resident of North Attleboro and he has been instrumental in making the change. The board of trade took an active interest in securing a location for the new firm and to them may be given much of the credit for its advent there.

During the week of February 21 a strike seemed imminent among the employees of the Taunton Copper Works, but the strike leaders and heads of the firm got together and a compromise was effected.

The Evans Stamping and Plating Company of Taunton is adding several large consignments of new machinery to its plant.

It has been reported that the Mossberg Manufacturing Company, makers of tools and manufacturing machinery, are about to make a large addition to the present plant. The firm is working twenty-four hours a day with three shifts of men.—J. S. McK.

BUFFALO, N. Y.

March 6, 1916.

Trade conditions in this market are about normal. While it is true that some firms report a slight falling off, yet this only means that their extra rush is now over and that they are no longer working overtime. The business which prevails today, that is with most of the concerns, is the regular, normal trade. And as soon as weather conditions change, some of the metal men believe that there will be a little boom in this market. At present, people are only ordering those things which they will need immediately.

Money is extremely tight in this market. The local men are experiencing all sorts of difficulties with their collections and they say that even the most prompt concerns are beginning to hold up their payments. It is said that it has been years since such a state of affairs has prevailed.

Another difficulty is metals. Copper, tin and spelter are very hard to get unless one wishes to pay almost prohibitive prices. When The Metal Industry correspondent asked some of the dealers if they thought metals would soar much higher he was told that they would. They claim that copper is being consumed too rapidly by the war order people and therefore it is impossible to keep the price down. They believe prices will continue to climb as long as the war continues. Some have even gone so far as to say that if the prices continue to soar up, some of the metal concerns will be thrown into bankruptcy because of their long term contracts under which they are working.

Then in addition to this is the labor difficulty. The moulders are demanding an increase of 50 cents a day, and the core makers 75 cents. Also, they do not want to work more than nine hours a day. This will be a death blow to some of the foundries, especially those with long term contracts.

The foundry trade is unusually good; but it shows signs of being spotty. With the exception of one or two foundries, everyone is being worked to a normal capacity.

The Unique Brass Foundry Company are beginning to move into their new and larger foundry. This firm has just booked an order from the Pierce-Arrow people which will, alone, keep them busy until next August.

The National Bronze Foundry during the past month successfully cast four one thousand pound castings for one of the local breweries, and at present they are very busy.

Owing to an increase in business, the Schnell Bronze Bearing Company are making a number of alterations in their foundry so that they might accommodate more moulders.

The finishing and rolling mills are as active as ever filling war orders. No particular branch of the metal trade in this market has enjoyed such prosperous times as they have during the past sixteen months. Some of these plants have grown to vast proportions.

The Zero Valve and Brass Company is doing some particularly nice 2½-inch brass rail work for the Larkin Company.

The Buffalo Copper and Brass Rolling Mill is working its forces night and day in order to keep pace with the influx of orders, which are mostly foreign.

There has been a slight falling off in the electroplating trade during the last week of February; but nevertheless March is expected to be a big month. Building operations which will soon begin will stimulate trade. Some difficulty is being encountered in the procuring of chemicals.—J. W. G.

NIAGARA FALLS, N. Y.

March 6, 1916.

Trade conditions in this city are brisk. Inquiries are making their appearances in increasing numbers. Metal prices are strong and the outlook for the future is very encouraging. Some long term contracts have been closed which will keep these plants busy for some time to come, in fact, this year is beginning to show signs of being a record breaker.

On February 29, the local metal men and others celebrated Prosperity Day. A giant dinner was staged by the Niagara Falls Board of Trade, for the occasion, at the local state armory. Some very prominent speakers spoke. One indication that Niagara Falls is becoming more and more prosperous is because three of its banks, alone, have increased their deposits about 60 per cent. since 1910. This is considered to be remarkable when compared with the size of the city.

The Titanium Alloy Manufacturing Company and the Frontier Brass Foundry are unusually busy. They are filling a number of large orders.

Owing to a large war order which the Niagara Searchlight Company has just received from the French Government they find that they will have to double the size of their two-story plant. Building operations will be begun at once. This order is only one of a number of war orders which this firm has received since the beginning of the present European war.

Two small fires visited the non-ferrous metal trade in this city during the past month. They are the Richmond Dental Supply Company and the Hooker Chemical Company. The latter company is doubling the size of their plant.

C. E. Leffel, superintendent of the Spirella Company, recently was maliciously attacked by an unknown foreigner one evening near his home. In the combat Mr. Leffel's nose was broken. He is recovering quite rapidly. The Spirella Company is quite active at present.—G. W. G.

COLUMBUS, OHIO

March 6, 1916.

The metal market in Columbus and central Ohio territory has been firm in every respect during the past month. The general tendency of prices is upward and little weakness has developed in any direction. The volume of business is better as manufacturing continues to expand. This is especially true of copper, tin and aluminum. But there is no especial weak point in the market and prices are well maintained on all items.

The prospects for business are exceedingly bright according to metal men and manufacturers. War munitions is one of the big lines, but demand is not confined to that class of manufacturing but is general. Quite a few new metal using concerns are being organized in Ohio.

Copper is strong all along the line. No. 1 crucible shape copper is quoted at 25 to 26½ cents per pound. Red brass is also higher, selling at 22 cents, while yellow brass scraps are quoted at 18¼ cents. Manganese is selling at 22 cents. Aluminum is one of the strongest points in the market, being quoted at 45 to 46 cents per pound. Tin is firm at 44 to 45 cents and zinc at 21¾ to 22 cents. Babbitt metal is in good demand and the same is true of all typemetals.

The Eclipse Plating and Manufacturing Company of Cleveland, Ohio, has been incorporated with a capital of $5,000 to do plating and metal manufacturing. The incorporators are Peter Verburg, Joseph Hudik, Johan Hudis, George H. Randall and John W. Abel.

The Lafayette Stamping & Enameling Company of West Lafayette, Ohio, has been incorporated with a capital of $50,000 to do stamping and enameling. The incorporators are H. R. McCurdy, L. P. Gallagher, M. D. Custer, J. Q. Adams, and Ed. Le Rittilley.—J. W. L.

CINCINNATI, OHIO

March 6, 1916.

The steady rise in the price of metals during the past few months might have been expected to have a depressing effect upon the business of foundries and others handling them; but it appears that the contrary has been the case lately. There was a falling off in the demand for castings a few weeks ago, probably caused by the high prices, as consumers felt justified in postponing orders, on the ground that they might be able to get them filled later at lower prices. As figures kept getting higher, however, this feeling changed radically, and the present view of machinery and other manufacturers is that metals are going to be scarcer and higher for some time to come. The natural result has been a rush to lay in stocks now, in order to avoid the necessity of buying later at higher prices; and this has renewed activity with the foundries, forcing capacity operations in most cases.

At present most of the buying still seems to be for the account of concerns requiring equipment for use in filling orders for war materials of various sorts. There has been no perceptible diminution in this class of business, and the trade continues to profit by it to a marked degree. At the same time, it is also true that the increasing activity of domestic business, with renewed buying of material and equipment by the railroads, is having its effect on the metal and machinery trades. For instance, lathes and other equipment used in the manufacture of munitions are identical with those used in the making of goods for more peaceful uses; and while it is for that reason difficult to determine, at least at the foundry, which class of business is making the demand, it is certain that many purchases are being made on behalf of concerns having nothing to do with war orders. This kind of business, of course, is much more welcome if only for the reason that it is likely to be more permanent, than the other, and the trade would like to see it gradually become larger. With the sustained activity in both domestic and foreign, munition and peaceful manufacturing departments, prospects for the future seem to be about as fully guaranteed by present conditions as could well be asked.

The L. Hilb Smelting & Refining Company has been inconporated in Cincinnati, with a capital stock of $25,000, to handle copper and other metals on a considerable scale. Leonard S. Weiler, Casper J. Goldbert, Charles R. Hilb and Enoch L. Stricker are interested.

At the annual election of the Lunkenheimer Company, one of the largest manufacturers of valves and other metal specialties in Cincinnati, the following officers were re-elected: Edmund F. Lunken, president; E. T. Lunken, vice-president; Frederick Schaefer, second vice-president, and David C. Jones, secretary. William H. Muench, who has been with the company 28 years, tendered his resignation as treasurer, and that office was consolidated with that of secretary, Mr. Jones holding both hereafter. Mr. Muench's resignation was received by the company with regret, and he was presented with several handsome gifts by officers and employees in token of their esteem.—K. C. C.

DETROIT, MICH.

March 6, 1916.

Spring outlook in the metal trades here was never so encouraging as at this time. Manufacturers of brass, copper and aluminum products report sufficient business to take them well along into the summer months, with every indication of continued activities for many months following.

Manufacturers, one after another, are going into the munition business, large contracts having been signed within the last month. The Clayton & Lambert Company, at Piquette avenue and Beaubien street, is now operating night and day on shell contracts and is adding to its equipment and force of employees continually. This concern heretofore made a specialty of producing a high grade flow pipe for plumbers' use, but has not been as brisk lately. It is understood that as soon as the munition work started the factory again began to boom.

Although great quantities of war material are now being manufactured, thus far Detroit has experienced but little in the way

of strikes. Recently several arrests were made of persons accused of attempting to interfere with operations at the plant of the American Car and Foundry Company, but nothing could be charged against them and they were released. This is about the extent of troubles in Detroit in regard to the manufacture of war material for the Allies in Europe.

The two yards of the Great Lakes Engineering Works in Detroit, a concern which maintains a large brass foundry in connection with its other equipment, reports it has sufficient business ahead to keep hundreds of shipbuilders busy for the next two years. They have within the last few months booked contracts for the construction of twenty new boats. Most of these boats are for lake traffic to take the place of those lost in the storms of two years ago, and to take the place of others that have been taken to the Atlantic ocean since the war started.

Among the new corporations that have come into existence within the last two weeks is the Enterprise Brass Works of Muskegon, Mich., with a capital stock of $175,000, for the manufacture of brass and aluminum products.

The Michigan Electric Welding Company has increased its capital stock from $25,000 to $250,000.

While the manufacture of plumbers' supplies is not brisk at present, most of the plants engaged in this work are either producing war supplies or manufacturing automobile parts. There still seems to be plenty of work for the skilled mechanic in the copper, brass and aluminum plants, but there is little demand for unskilled labor.—F. J. H.

There is a general state of uneasiness among the metal concerns at the present time that is causing much concern, owing to the high prices prevailing in the market on all kinds of metals and raw materials of every description. Manufacturers of chandeliers and electric fixtures, also interior fittings of various kinds, find the demand for these goods above normal at this time of the year because of the general progress in the direction of modernizing of dwellings and the fitting up of new office buildings and residences in course of construction.

The automobile companies have also increased the prices of their cars, owing to the high prices prevailing for raw material, and have notified their agents throughout the country accordingly. The brass mills are quite busy here and have still heavy orders on their books. The local manufacturers of plumbing and steam brass goods are increasing their labor forces, which were cut down over a year ago, owing to the increased building operations going on all over the country and the stocks in jobbers' hands having become exhausted.

The Capital Brass Works, located at Franklin and Chene streets, is running now to its full capacity. The Penberthy Injector Company, Holden avenue, is also busy on locomotive brass goods, as the different railroad companies are placing some good orders at the present time. The Canadian Detroit Lubricator plant at Walkerville, Ont., is running to its full capacity on time fuses for shrapnel shells, which they have a large order for.—P. W. B.

LOUISVILLE, KY.

March 6, 1916.

The feeling in the metal industry of the Louisville district is showing a gradual improvement. The coppersmiths and workers in various high grade metals report an improvement all along the line, and the outlook is brighter than it has been for some time. Copper prices are still advancing steadily and while prices are very high they are not said to be overly high considering the demand and existing conditions. Basic prices on ingot copper are quoted at 28½ and 29 cents; tubes, 38 and 39 cents; brass tubes, 39 and 40 cents; sheep copper, 34 and 35 cents.

J. A. and Joe McGill, of the American Brass & Plating Works, have purchased the three-quarter controlling interest of the firm of Hines & Ritchey in the American Brass a Plating Company, and now own practically all of the stock in the latter concern.

Manufacturing jewelers of Louisville are much pleased with the big drop in platinum which came down almost as fast as it went up. Platinum, which was recently quoted at $125 an ounce, is now worth about $80. However, the demand for platinum work continued even while the market was up. This metal is now one of the most popular and many fine pieces are being made from it. A counterfeit goldpiece, made of platinum at a time when platinum was considered an ordinary metal, recently brought almost $30 whereas its value when made was only a few cents.

Announcement has been made of a change in the management of the W. P. Davis Company, copper and brass jobbers of Louisville, whereby F. H. Sparks becomes the active manager, succeeding W. P. Davis. The latter continues to hold a large interest in the concern but is now general manager of the Knoxville, Tenn., Iron Company, and the Cross Mountain Coal Company, of Knoxville, succeeding T. I. Stevenson.

The Independent Brass Foundry reports that at present there is not any great demand for special castings, as the price of metals is so high that many concerns are putting off buying until more propitious times. The concern is working on a few odds and ends, but hasn't any big work scheduled for delivery.

The Moran Flexible Steam Joint Company, manufacturers of plumbing goods and operators of a brass foundry, have reduced their capital stock from $25,000 to $20,000. The company has purchased a building on Main street, owned by the E. A. Stege estate, and is preparing to remove the business to this new location as soon as repairs, which will cost about $6,000, can be made. The new building will be considerably larger than the old one on Third street.

Hospital Management, published at Louisville, Ky., has made its appearance, a feature being a department for industrial hospitals. It is announced that this department will be a permanent and important feature of the publication, the idea being to record developments in the rapidly growing field of welfare work. The leading article in Hospital Management for February describes the hospital of the Youngstown, O., Sheet & Tube Company, which was recently opened with Dr Sidney McCurdy in charge.—G. D. C.

TRENTON, N. J.

Strikes during the past month again greatly interfered with the progress of the metal industry in this section and caused a complete shutdown of one big plant. The plant forced to suspend for a few days was that of the John A. Roebling's Sons Company, where copper is used extensively. The concern fitted up one of the big dwelling houses it recently purchased to enlarge its plant and turned it into a living quarters for strike-breakers. Negroes from Virginia were imported here and given a free living to beat the strikers. While the strike was on nearly 6,000 employees were affected by the shutdown. The copper cable department is very busy at the present time and is working overtime in an effort to catch up with the orders. The police have been asked to have a detail of officers to watch the house to prevent an attack from the strikers. The men remain in the plant during the hours for meals and the company furnishes them with food.

On top of this trouble came the general strike of the moulders throughout the city. The only plant not affected by the moulders' strike is the J. L. Mott Company. Differences with the ninety moulders at this works were adjusted some time ago and these men refused to walk out. The employers claim that the moulders demand the same wages being paid in some plants in Philadelphia, where war munitions are being paid. The employers further stated that it would be impossible to operate their plants at that rate. When the Mott strike was inaugurated some time ago it did not last long. A rush of war orders caused the company to give in to the men. The laborers at the Mott works also went on strike the latter part of January for an increase in wages of from 17 to 20 cents an hour. The company finally granted the demands.

The McFarland Foundry and Machine Company, one of the plants affected by the strike, is controlled by the Roebling interests. Fred M. Staples, secretary and general manager of the company, reports that business is holding its own at the present time. "We are not handling any war orders," he said, "and do not care to turn out munitions. There is

enough trouble without manufacturing war supplies. The business outlook appears to be encouraging."—C. A. L.

NEWARK, N. J.

March 6, 1916.

Business continues to improve in Newark and vicinity. The gain is not rapid, but it is steady, conditions gradually approximating the normal. In some lines the improvement is more noticeable than in others, and there is somewhat of an ebb and flow, but the volume of business is steadily increasing. It goes without saying that concerns making war munitions are very busy, but conditions described above refer to general business aside from that. Many manufacturers state that business during January and February of this year was considerably ahead of the corresponding months last year. Of course, this is not an indication of normal business, for last year was a poor year. But it does indicate a tendency to recovery, and the fact that some manufacturers state that the opening business of this year is ahead of that of the past three or four years shows that there has been a substantial gain. The jewelry business has kept up very well since the Christmas trade and fundamentally seems in better condition than for several years back. As jewelry is a luxury, this indicates that people have more money to spend than they did six months ago. Many jewelry manufacturers state that there has been a demand of late for more high grade jewelry than has been called for before. Part of this is from those who have struck it rich in the stock market or in the war munitions field, but not all of it. Manufacturers of metal goods of all kinds are much more optimistic than they were a few months ago, as far as the volume of business is concerned. The discouraging feature of the situation is the high cost of chemicals, metal materials and very nearly everything else in any way connected with the manufacturing business. With the cost of materials constantly increasing, but with the possibility of a break at any time, manufacturers do not know how to order advantageously. They fear to lay in a supply at present prices for fear they will fall and then they will suffer a great loss. At the same time not to order means that they will probably have to pay much more for the materials later, and perhaps may not be able to get as great a supply as they need.

Scrap of all kinds is being gathered in. The pins in old false teeth, the wire in the older makes of electric light bulbs, old jewelry of styles no longer popular and platinum in many other unprofitable forms is being searched for everywhere to add to the little stock of new metal that remains on hand.

Prices of platinum are soaring and the supply practically exhausted.—R. B. M.

NEWS OF THE METAL INDUSTRY GATHERED FROM SCATTERED SOURCES

The United Smelting and Aluminum Company, New Haven, Conn., has opened a branch sales office in New York City at 26 Stone street for the convenience of the New York trade.

The Dueber Watch Case Manufacturing Company, Canton, O., are soliciting inquiries with specifications for sheet brass and German silver in strips, discs and cups. They also manufacture jewelers bars.

The smelter of White and Brother, Inc., at Philadelphia, Pa., which was completely destroyed by fire recently is being rebuilt. The firm hopes to resume operation again within the next few months.

The Metal Specialties Company, Attleboro, Mass., has been started under the management of Harry R. and Charles L. Holbrook to manufacture metal specialties and will carry on business in the Makepeace Building, 8 Gardner street.

The International Nickel Company, New York, has come to an agreement with the British War Office, whereby the latter will take about 20 per cent. of the nickel company's annual output. This is the largest single order ever accepted by the company.

The Premier Aluminum Foundry Company, Cleveland, O., has placed a new aluminum, brass and copper foundry in operation on Ivanhoe road. The company reports that all new machinery and equipment, etc., have been purchased for the new foundry.

The Simmons Company, Kenosha, Wis., will begin at once the erection of a tube mill 100x400 feet, as an addition to its present operations, which are as follows: brass foundry, tool room, stamping, galvanizing, plating, polishing, japanning and lacquering departments.

The Bronze Metal Company, Meadville, Pa., under date of February 19, 1916, states that the published report that they were making plans for an addition to their plant, to cost about $80,000 and that they expected to place contracts for equipment in a short time is not true.

The Stanley Bronze Company, Bridgeport, Conn., has been granted permission to erect a brick factory building at an aggregated cost of $42,850. When the addition is ready it will be one of the best equipped foundries in that section of the country, and they are also considering the purchase of a new compressor.

The Crescent Brass and Manufacturing Company, Cleveland, Ohio, states that only preliminary plans have been made for the erection of a one-story factory addition which will cost $15,000. Among the different departments operated by this company are the following: brass foundry, brass machine and cutting-up shop, spinning, stamping, brazing, soldering, plating, polishing and lacquering departments.

The Eureka Pneumatic Spray Company, manufacturer of air compressors, air brushes and ventilating systems, 62-64 Ninth avenue, New York City, announces that on May first an addition of five thousand square feet will be added to its factory and that they will carry the largest stock of air compressors and accessories in the United States and extend their line of spraying apparatus into numerous other fields.

B Beckring, secretary of the Acme Tent & Awning Company, Tenth and North Market streets, St. Louis, Mo., advises The Metal Industry that they have begun the manufacture of buffing and polishing wheels and intend to carry in stock a full line of supplies for platers and polishers. They would like to hear from manufacturers of emery paste and other platers' and polishers' supplies, who desire representation in their territory.

A contract has been awarded by the Peerless Tube Company, Broadway and Murray street, New York, manufacturer of collapsible tubes, to Salmond Brothers, Arlington, N. J., for the construction of an additional factory alongside its present plant on Locust avenue, Bloomfield, N. J. The company is now working both day and night and plans to have its new plant complete about March 1. A rolling mill, stamping, lacquering, tool and grinding room are the different departments operated by the Peerless Company.

The Boissier Electric Company, 205 West Nineteenth street, New York, announce that they are making a specialty of furnishing complete formulae and instructions for installing and operating electro galvanizing plants for dull or bright finishes with inexpensive solutions. They state that their instructions are clear and accurate; that no secrets are withheld; that they place their customers in a position to do the best class of work

at the lowest possible cost. They also ask attention to their latest mechanical devices for barrel and still-tank electroplating.

The Central Nickel Plating Company and the Alex. T. Bagley Company of Los Angeles, Calif., have consolidated their plating, polishing and enameling business and will operate under the latter name. The company has taken a lease on about 6000 square feet in a building on Boyd and Los Angeles streets, where extensive alterations are being made to take care of the increased business of this concern. Besides operating plating, polishing, japanning and lacquering departments they are also in the platers' and polishers' supply business.

A very handsome exhibit has been received at the office of THE METAL INDUSTRY from W. H. Legate of the Techno-Chemical Laboratory, Hartford, Conn. This exhibit consists of a set of knives and forks, the handles of which have been treated by a new process for a blue finish. It is said by Mr. Legate that this finish is cheaper than any now on the market and produces remarkable lasting results. He says that it is extremely easy to produce the finish, only taking a few minutes for each piece. The samples are on exhibition at this office.

Metals Production Equipment Company, successors to the Quigley Furnace and Foundry Company, announce that they now have a brass rolling mill at Springfield, Mass., containing eighty fires and five sets of rolls. They are now ready to produce brass in strips up to eighteen inches in width and practically of any thickness and are in a position to furnish strip brass, discs and cups. The officers of this concern are as follows: A. W. Erickson, president; W. S. Quigley, vice-president, and J. A. Valentine, treasurer.

The Gehnrich Indirect Heat Oven Company, Brooklyn, N. Y., has received another contract for eight radiator type enameling ovens for Stewart-Warner Speedometer Corporation, Chicago, Ill., making it the third order for Gehnrich ovens received from this house within three months. The company also just completed an installation at the John O. Heinze Company, Springfield, Ohio, of a battery of four ovens. Orders are now being filled for ovens to be delivered at two plants of the Western Electric Company, making a total of nine radiator type ovens installed at their different plants.

The Apollo Metal Works, La Salle, Ill., manufacturers of plated sheet metals, state that in spite of having only recently doubled the producing capacity of their nickel-tin plate and brass-tin plate departments, they are obliged to work both day and night shifts. They give credit to their advertising in THE METAL INDUSTRY for this prosperous condition, stating that THE METAL INDUSTRY has brought them a number of good inquiries and they are now doing a much greater business than any of the officials of the company ever experienced since their connection with the manufacture of plated sheet metals.

The American Foundry Equipment Company, of Cleveland, Ohio, manufacturers of the well-known Wadsworth direct pressure system sand blast apparatus, and the Sand Mixing Machine Company, of New York City, manufacturers of the original and only auto sand cutting machine, have combined interests and moved into a new and up-to-date factory. The new plant, located at 1111 Power avenue, Cleveland, Ohio, provides for the necessary expansion and affords greater manufacturing and development facilities. A stock department of duplicate or repair parts is also planned to assure a still larger measure of service in the future for the customers of both concerns. The executive offices of both concerns will be maintained at 52 Vanderbilt avenue, New York City, in charge of V. E. Minich, vice-president and general manager.

A laboratory and consulting office for electro platers and manufacturers has been established by Wilfred Thompson and George O. Morrison, B.A., consulting electro chemists, electro-platers and research chemists, at 10 Silver avenue, Toronto, Canada. Messrs. Thompson and Morrison are prepared to give expert opinions on all solutions, finishes and analytical methods for standardizing solutions. They offer their services for analyzing anodes and all plating compounds and materials, advising regarding improvements in electroplating processes, remodeling of plating departments and all similar work. Mr. Thompson has had 15 years' experience in all kinds of plating, and was foreman plater for the Toronto Silver Plate Company, and Canadian Wm. A. Rogers, Inc. Mr. Morrison is a graduate chemist of Toronto University and has had practical experience in electro-plating.

INCREASE IN CAPITAL STOCK

The Grand Rapids Brass Company, Grand Rapids, Mich., has increased its capital from $250,000 to $300,000 to provide for its new branch plating at Belding, Mich., and other extensions. This company operates a brass and bronze foundry, tool and grinding room, stamping, tinning, brazing, plating, polishing and lacquering departments.

CHANGE IN FIRM NAME

The International Acheson Graphite Company, Niagara Falls, N. Y., manufacturer of graphite products, has changed its name and hereafter will be known as the Acheson Graphite Company.

The American car and Ship Hardware Manufacturing Company has changed its firm name to the Johnson Bronze Company, manufacturer of bushings, with main office and factory at New Castle, Pa. The company states that the new name will not interfere with the policy or personnel of the business and that the plant is being enlarged in order that they may be in a position to serve customers to better advantage.

REMOVAL

The Bloch Metal Stamping Company, Inc., has moved from 94 High Street, Brooklyn, N. Y., to 88-90 Walker street, New York City. Their telephone number is "Franklin 630."

The Lober Art Brass and Specialty Company, Toledo, O., manufacturers of aluminum, brass, copper, steel and zinc spinnings, has moved into its new building at 124-130 Eleventh street, where they will have a floor space of 6000 square feet. This company is now giving regular employment to twenty-four metal spinners and has also added a stamping and plating department to its regular business.

The Art Stone Manufacturing Company, New York, N. Y., announce that, owing to the increased volume of business, they have been obliged to move into larger quarters, and can now be found at 282 Ninth avenue, where they have excellent facilities for continuing their work of refinishing with lacquers and lacquer enamels. I. Huppert, manager of the above company, will be glad to hear from his old customers or from anyone interested in finishers of any kind.

ELECTION OF OFFICERS

The Union Metal Manufacturing Company, Canton, Ohio, manufacturer of ornamental lighting standards, at its recent annual meeting elected C. C. Barrick president, C. L. Eshelman vice-president, D. C. Barrick secretary, and L. M. Barrick treasurer. This company operates the following departments: tool and grinding room, casting shop, galvanizing, stamping, soldering, polishing, japanning and lacquering.

At a recent meeting of the Michigan Copper and Brass Company, Detroit, Mich., the following officers were elected for the ensuing year: David M. Ireland, president; James E. Danaher, first vice-president; Fred T. Moran, second vice-president; Alfred L. Simmons, secretary; J. R. Connell,

treasurer, and Benjamin F. Brusstar, general superintendent. The directors are as follows: Fred M. Alger, George H. Barbour Sr., Benjamin F. Brusstar, E. J. Corbett, James E. Danaher, Jeremiah Dwyer, D. M. Ireland, Fred T. Moran, James T. Whitehead, W. A. Gorby, and A. L. Simmons.

At the annual meeting of the stockholders of the American Metal Products Company, manufacturer of "Ampco" bronze die casting of Milwaukee, Wis., the old board of directors were re-elected, as follows: Peter J. Weber, president; Henry C. Brelie, vice-president; William J. Eberle, secretary and treasurer; Richard Gaertner, manager, and Charles E. Helm and August Littmann. The officers reported that although the present plant was being worked to full capacity, it was impossible to keep up with the demand, as orders on hand were plentiful, and there are many large orders pending which absolutely necessitate the immediate installation of additional facilities and therefore the company is contemplating the erection of a larger plant and the purchase of additional equipment.

INCORPORATIONS

Business organizations incorporated recently. In addressing them it is advisable to include also the names of the incorporators and their residence. Particulars of additional incorporations may frequently be found in the "Trade News" columns.

To deal in metals.—J. S. Turner White Metal Company, New Brunswick, N. J. Capital, $50,000. Incorporators: George S. Turner, Sarah J. Turner, John S. Turner.

To deal in jewelry and metals.—Bioren Brothers, Inc., Newark, N. J. Capital, $10,000. Incorporators: Charles J. Bioren, Sylvan J. Rauch, Newark; Elmer W. Boan, Kearny, N. J.

To manufacture metal goods.—Copely Manufacturing Company, Irvington, N. J. Capital, $25,000. Incorporators: William H. Peck, Glen Ridge; Herman Crowe, Emerson; John W. Crandall, New York.

To manufacture heavy duty and anti-friction bearings, ingot copper and brass.—Waterbury Brass and Bronze Company, Waterbury, Conn. Capital $10,000. Incorporators: Henry L. Silver, Henry W. Even and Bernhard Silver. In addition to a brass and bronze foundry this company will operate an aluminum foundry.

FOREIGN TRADE OPPORTUNITIES

For addresses of these enquiries apply to Bureau of Foreign and Domestic Commerce, Washington, D. C., and give file numbers.

Electrolytic Copper, No. 20222.—An American consular officer in the Netherlands writes that a firm in his district is in the market for electrolytic copper. Reference is given. Correspondence may be in English.

Copper, Tin and Solder, No. 20205.—A man in Greece informs an American consular officer that he desires to communicate with American exporters of copper, tin and solder. Terms and possible dates of shipments are desired immediately. Correspondence should be in French.

Sheet Brass, No. 20274.—An American consular officer in Spain reports that a firm in his district desires to establish commercial relations with American manufacturers and exporters of sheet brass 10 and 12 millimeters (0.3937 and 0.4724 inch) thick. References are given. Correspondence may be in English.

INQUIRIES AND OPPORTUNITIES

Under the directory of "Trade Wants" (published each month in the rear advertising pages), will be found a number of inquiries and opportunities which, if followed up, are a means of securing business. Our "Trade Want Directory" fills wants of all kinds, assists in the buying and selling of metals, machinery, foundry and platers' supplies, procures positions and secures capable assistants. See Want Ad. pages.

PRINTED MATTER

Metal News.—The Metals Trading Corporation, metal brokers, New York, have issued a bulletin giving interesting information concerning the prices of the metal market. The bulletin also gives some data relating to the metal business in general.

Metals.—The American Metal Market, 81 Fulton street, New York, has issued an eight-page pamphlet which is a statistical supplement of the Official Daily Metal Market Report. This pamphlet gives the daily prices and fluctuations in the metals; copper, tin, lead, antimony, spelter, etc., for the year 1915.

Foundry Equipment.—The Whiting Foundry Equipment Company, Harvey, Ill., has issued catalogs Nos. 118 and 119. No. 118 supersedes No. 95 and is entirely taken up with illustrations and descriptions of the Whiting cupola of various sizes and styles and accessories. Catalog No. 119 supersedes No. 107 and is devoted to the subject of air hoists. Copies of these catalogs may be had upon request.

Die Castings.—The Indiana Die Casting Company, Indianapolis, Ind., has issued a little booklet called "Die Casting Card Index Library." The booklet contains twenty-odd pages and gives complete description of the rotary type of die casting machines which are made by the company and also describes the different number of die castings it is possible to turn out by the use of this machine. They also die-cast bearings in any standard or special alloy.

Clay and Graphite.—The Joseph Dixon Crucible Company, Jersey City, N. J., has issued a little folder in which they give interesting facts relating to Dixon's clay and graphite mixture, which is used for cementing, mending and patching furnace linings, fire boxes and ladles. As this material is made from the same stock that goes into graphite crucibles it has great heat resisting qualities and forms a refractory mixture which greatly lengthens the life of the article it is used on.

Metal Cyanides.—The Roessler and Haslacher Chemical Company, 100 William street, New York, announce that they are about to issue a new booklet entitled "The Metal Cyanides for Copper, Brass, Bronze, Zinc and Silver Solutions." This booklet contains recipes and other information in regard to the installation and maintenance of plating baths. It also points out the advantages of and decided economy claimed for the metal cyanides. The booklet can be had for the asking.

Oils.—The N. B. Cook Oil Company, 148 Front Street, New York, have issued a large hanger showing an interesting bird's eye map of New York City and surrounding territory, and showing the location of their main office and store house at New York and factories at Jersey City and Port Monmouth, N. J. This company imports and refines many different kinds of oils. Their "N. B. C." brand of whale oil and their palm oil are extensively used in the metal trades. They produce engine and dynamo oils, auto greases, etc., and supply practically any kind of oil desired by the trade.

CATALOG EXHIBIT

An exhibition of every kind of catalog may be seen at The Metal Industry office, 99 John street, New York. The Metal Industry is prepared to do all of the work necessary for the making of catalogs, pamphlets, circulars and other printed matter. Estimates will be furnished for writing descriptions, making engravings, printing, binding, for the entire job from beginning to end or any part of it.

METAL MARKET REVIEW

COPPER.

New York, March 6, 1916.

The price of copper during the month of February has been pushed up another 2 cents per pound and at the end of the month the price of spot electrolytic is about 28¼ cents with the dealers asking even higher prices. Futures can be bought at from one cent to possibly 1½ cents below the spot price, according to the time of delivery. The price of Lake copper has more or less followed the advance in electrolytic and casting copper has trailed along at about one cent below the price of the higher grades.

The demand for copper during the month has not been very active, consumers must all be pretty well covered and at the close the market has a slightly easier appearance for the reason the futures are more freely offered at concessions of one to 1½ cents per pound below the ruling spot price.

The exports for the month are a little over 20,000 tons. This amount does not show any specially large demand from the Allies and does not match up very well with the fairy stories given out from time to time about large foreign inquiries in the market, etc., etc.

A cable received from London in New York March 2 stated that the British Government prohibits speculation in iron, steel, copper, spelter, brass, lead, antimony, nickel, tungsten, molybdenum, ferro alloys and any other metal which may hereafter be specified.

Dealings in copper, lead, spelter and iron suspended indefinitely.

This means there will be no copper cables from London and the market price of copper, hereafter, will have to be made in America.

The effect of this drastic action by the British Government, at the moment, is problematical. John D. Ryan, president of the Anaconda Copper Mining Company, in a statement on this new development among other things is reported to have said:

"The price of standard copper in London has had very little, if any, inflence upon the American seller of copper and the price of copper is not and has not been for years affected by London fluctuations to any considerable extent." While it is true since the war in Europe the London prices have been more or less unsatisfactory, owing to the fact that copper in England could not be exported, but before that time the London quotations were always taken as the basis for the American copper market, and it did not matter whether the price of electrolytic advanced or not; if standard advanced £1 in London, the price of copper here was promptly marked up about ¼ cent per pound. If Mr. Ryan is not aware of this price movement in copper in New York, he certainly can't know much about the New York copper market.

The British Government evidently got disgusted with the way the vital necessities were being exploited and have done their best to put a stop to this very apparent manipulation of the copper market at the expense of England and her allies.

Of course, no one in the London copper market believes that there is any scarcity of copper in America and there are not many that so believe over here.

The buying during the month has been anything but active, the exports were only about 20,000 tons, and there must be well over 100,000,000 pounds of copper being carried by the large producers today. That seems to be the reason the producers are not issuing the monthly statistics.

Later, March 6, London cables that a committee of the London metal exchange called on the munitions minister on Friday, March 3, and the government agreed to limited trading, so cable prices are received from London now as usual.

Spot electrolytic is obtainable at around 28 cash f. o. b. New York; April, May and June at from 27½ to about 26½, and Lake copper at about the same price. Casting is quoted at around 26¾ cents.

TIN.

The tin market has held fairly steady during the month. The price opened at about 21.80 and advanced to 50 cents on the 28th on a squeeze in the spot stocks and the month closed with spot tin quoted at 48 cents.

LEAD.

The price of lead has been advanced 30 points during the month, from 6.10 at the opening to 6.30 New York basis the trust price at the close. The independents are getting from 10 to 20 points advance over the trust price.

March 3, the trust advanced its price of lead to $6.40 New York basis. This announcement had no effect on the market. As a matter of fact they are not sellers at this price; the actual market price for lead is $6.50 to $6.60 New York and $6.40 to $6.50 East St. Louis.

SPELTER.

The spelter market has been firm and prices advanced about 2 cents per pound during the month of February, from 18¾-18⅞ at the opening to 20¾ at the close. There have been no special features to note and the market at the close has a sagging tendency.

ALUMINUM.

The aluminum market is firm again and the spot stock of No. 1 Virgin aluminum has been pretty well cornered. Prices have advanced from 6 to 7 cents a pound for No. 1 Virgin and the other grades are 4 to 5 cents higher. There has not been any specially active export demand but there has been a steady advance in price owing to a scarcity of sellers. At the close spot Virgin has sold at 63 cents, April and May is offered at 62 cents and June and July are offered at around 60 cents. The 98-99 pure remelt grade is offered at 58 to 60 cents.

ANTIMONY.

There has been very little change in the price of antimony. Opening at 43¾ for Chinese and Japanese, the price at the close is about 44 cents. The market is very quiet.

QUICKSILVER.

The quicksilver market is easier and prices are about $40 per flask lower. Spot quicksilver is offered today at $260 a flask and futures are offered at $20 to $30 a flask lower but there are no buyers as everyone is looking for lower prices.

SILVER.

The price of silver is about the same as a month ago and the market has been very dull. New York is quoted at 56⅝ cents and London at 27 1/16d.

PLATINUM.

There are sellers of platinum at the end of February at $88.00 per ounce and the market seems to be a little easier.

SHEET METALS.

Sheet copper has been advanced 2 cents per pound during the month following the advance in ingot copper and is quoted today at 35 cents against 33 at the opening. High sheet brass is quoted at 38 to 40 cents and coper wire at 29½ to 29¾ cents.

OLD METALS.

The old metal market has been quite active and prices for copper scrap are all higher. Lead spelter and aluminum scrap are higher on account of the advance in ingot metals.—J. J. A.

FEBRUARY MOVEMENTS IN METALS

Copper.	Highest.	Lowest.	Closing.
Lake	28.50	25.50	28.25
Electrolytic	28.75	25.25	28.25
Casting	27.00	24.25	27.00
Tin	50.00	41.50	48.00
Lead	6.50	6.10	6.50
Spelter	21.20	18.70	20.70
Antimony (Chinese and Jap.)	45.00	43.00	44.25
Silver	57	56½	56⅝

WATERBURY AVERAGE

The average prices of Lake Copper and Brass Mill Spelter per pound as determined monthly at Waterbury, Conn.:

Lake Copper. 1915—Average for year, 18.94. 1916—January, 24.75. February 27.75.

Brass Mill Spelter. 1915—Average for year, 17.50. 1916—January, 22.25. February, 22.75.

Metal Prices, March 6, 1916

NEW METALS.

	Price per lb. Cents.
COPPER—DUTY FREE. PLATE, BAR, INGOT AND OLD COPPER. Manufactured 5 per centum.	
Lake, carload lots, nominal	27.00
Electrolytic, carload lots	27.00
Casting, carload lots	26.75
TIN—Duty Free.	
Straits of Malacca, carload lots	47.50
LEAD—Duty Pig (Bars and Old 25%; pipe and sheets 20%. Pig lead, carload lots	6.55
SPELTER—Duty 15%.	
Brass Special	22.00
Prime Western, carload lots, nominal	20.78
ALUMINUM—Duty Crude, 2c. per lb. Plates, sheets, bars and rods, 3½. per lb.	
Small lots, f. o. b. factory	72.00
100-lb. lots, f. o. b. factory	66.00
Ton lots, f. o. b. factory	63.00
ANTIMONY—Duty 10%.	
Cookson's cask lots, nominal	.....
Hallett's cask lots, nominal	.....
American	44.50
Chinese, Japanese	44.50
NICKEL—Duty Ingot, 10%. Sheet, strip and wire 20% ad valorem.	
Shot, Placquettes, Ingots, Blocks	45.00
ELECTROLYTIC—5 cents per pound extra.	
MANGANESE METAL	nominal
MAGNESIUM METAL—Duty 25% ad valorem (100 lb. lots)	5.00
BISMUTH—Duty free	nominal
CADMIUM—Duty free nominal	1.80
CHROMIUM METAL—Duty free	.75
COBALT—97% pure	2.00
QUICKSILVER—Duty, 10% per flask of 75 pounds	275.00
GOLD—Duty free	$20.67
PLATINUM—Duty free	$88.00 to 100.00
SILVER—Government assay—Duty free	.56¾

INGOT METALS.

		Price per lb. Cents.
Silicon Copper, 10%	according to quantity	33 to 35
Silicon Copper, 20%	" "	40 to 42
Silicon Copper, 30% guaranteed	" "	48 to 50
Phosphor Copper, guaranteed 15%	" "	34 to 38
Phosphor Copper, guaranteed 10%	" "	32 to 36
Manganese Copper, 30%, 2% Iron	" "	33 to 37
Phosphor Tin, guaranteel 5%	" "	59 to 62
Phosphor Tin, no guarantee..	" "	44 to 47
Brass Ingot, Yellow	" "	15 to 18
Brass Ingot, Red	" "	19 to 21
Bronze Ingot	" "	20 to 23
Parsons' Manganese Bronze Ingots	" "	29 to 30½
Manganese Bronze	" "	28 to 33
Phosphor Bronze	" "	18 to 19½
Casting Aluminum Alloys....	" "	45 to 50

PHOSPHORUS—Duty free.	
According to quantity	35 to 40

OLD METALS.

Dealers' Buying Prices. Cents per lb.		Dealers' Selling Prices. Cents per lb.
23.00 to 24.00	Heavy Cut Copper	26.00 to 27.00
22.50 to 23.50	Copper Wire	25.00 to 26.00
18.00 to 19.00	Light Copper	22.00 to 23.00
17.50 to 18.00	Heavy Mach. Comp	19.50 to 20.00
13.50 to 14.00	Heavy Brass	15.50 to 16.00
11.00 to 12.00	Light Brass	13.50 to 14.00
14.00 to 15.00	No. 1 Yellow Brass Turnings	15.50 to 16.00
14.00 to 15.00	No. 1 Comp. Turnings	16.00 to 17.00
5.25 to	Heavy Lead	.... to 6.00
12.00 to 13.00	Zinc Scrap	15.00 to 16.00
25.00 to 30.00	Scrap Aluminum Turnings	25.00 to 30.00
30.00 to 35.00	Scrap Aluminum, cast alloyed	25.00 to 30.00
35.00 to 40.00	Scrap Aluminum, sheet (new)	45.00 to 50.00
23.00 to 24.00	No. 1 Pewter	25.00 to 26.00
20.00 to 24.00	Old Nickel	20.00 to 24.00
20.00 to 24.00	Old Nickel anodes	20.00 to 25.00

PRICES OF SHEET COPPER.

BASE PRICE, 35 Cents per Lb. Net.

SIZE OF SHEETS.		64 oz. and over.	32 oz. to 64 oz.	24 oz. up to 32 oz.	16 oz. up to 24 oz.	15 oz.	14 oz.	13 oz.	12 oz.	11 oz.
Width.	LENGTH.	Extras in Cents per Pound for Sizes and Weights Other than Base.								
Not wider than 30 ins.	Not longer than 72 inches.	Base	Base	Base	Base	½	1	1½	2	2½
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	½	1	2	3	4½
	Longer than 96 inches. Not longer than 120 inches.	"	"	½	1	2	3	5	7	
	Longer than 120 ins.	"	"	1	1½					
Wider than 30 ins., but not wider than 36 inches.	Not longer than 72 inches.	"	"	Base	Base	1	2	3	4	6
	Longer than 72 inches. Not longer than 96 inches.	"	"	"	"	1	2	4	6	8
	Longer than 96 inches. Not longer than 120 inches.	"	"	1	2	3	4			
	Longer than 120 inches.	"	1	2	3					
Wider than 36 ins., but not wider than 48 inches.	Not longer than 72 inches	"	Base	1	2	3	4	6	8	9
	Longer than 72 inches. Not longer than 96 inches.	"	"	1	3	4	5	7	9	
	Longer than 96 inches. Not longer than 120 inches.	"	"	2	4	6	9			
	Longer than 120 inches.	"	1	3	6					
Wider than 48 ins., but not wider than 60 inches.	Not longer than 72 inches.	"	Base	1	3	5	7	9	11	
	Longer than 72 inches. Not longer than 96 inches.	"	"	2	4	7	10			
	Longer than 96 inches. Not longer than 120 inches.	"	1	3	6					
	Longer than 120 inches.	1	2	4	8					
Wider than 60 ins., but not wider than 72 ins.	Not longer than 96 inches.	Base	1	3	8					
	Longer than 96 inches. Not longer than 120 inches.	"	2	5	10					
	Longer than 120 inches.	1	3	8						
Wider than 72 ins., but not wider than 108 ins.	Not longer than 96 inches.	1	3	6						
	Longer than 96 inches. Not longer than 120 inches.	2	4	7						
	Not longer than 120 inches.	3	5	9						
Wider than 108 ins., but not wider than 120 ins.	Not longer than 120 inches.	4	6							

The longest dimension in any sheet shall be considered as its length.

CIRCLES, 8 IN. DIAMETER AND LARGER, SEGMENTS AND PATTERN SHEETS, advance per pound over prices of Sheet Copper required to cut them from .... 3c.

CIRCLES LESS THAN 8 IN. DIAMETER, advance per pound over prices of Sheet Copper required to cut them from .... 5c.

COLD OR HARD ROLLED COPPER, 14 oz. per square foot and heavier, advance per pound over foregoing prices .... 1c.

COLD OR HARD ROLLED COPPER, lighter than 14 oz. per square foot, advance per pound over foregoing prices .... 2c.

COLD ROLLED ANNEALED COPPER, the same price as Cold Rolled Copper.

ALL POLISHED COPPER, 20 in. wide and under, advance per square foot over the price of Cold Rolled Copper .... 1c.

ALL POLISHED COPPER, over 20 in. wide, advance per square foot over the price of Cold Rolled Copper .... 2c.

For Polishing both sides, double the above price.

The Polishing extra for Circles and Segments to be charged on the full size of the sheet from which they are cut.

COLD ROLLED COPPER, prepared suitable for polishing, same prices and extras as Polished Copper.

ALL PLANISHED COPPER, advance per square foot over the prices for Polished Copper .... 1c.

ZINC—Duty, sheet, 15%.	Cents per lb.
Carload lots, standard sizes and gauges, at mill......25 cent basis, less 8%	
Casks, jobbers' prices	26
Open casks, jobbers' prices	26½

Metal Prices, March 6, 1916

PRICES ON BRASS MATERIAL—MILL SHIPMENTS.

In effect February 25, 1916.

To customers who buy over 5,000 lbs. per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.36	$0.37	$0.38
Wire	.36	.37	.38
Rod	.36	.38	.39
Brazed tubing	.41	—	.43
Open seam tubing	.41	—	.43
Angles and channels	.41	—	.43

To customers who buy 5,000 lbs. or less per year.

	Net base per lb. High Brass.	Low Brass.	Bronze.
Sheet	$0.38	$0.39	$0.40
Wire	.38	.39	.40
Rod	.38	.40	.41
Brazed tubing	.43	—	.45
Open seam tubing	.43	—	.45
Angles and channels	.43	—	.45

[Note.—Net extras for quality for both sections of above metal prices are not quoted due to the fluctuations in the price of zinc.—Ed.]

BARE COPPER WIRE—CARLOAD LOTS.

30½c. per lb. base.

SOLDERING COPPERS.

300 lbs. and over in one order	35c.	per lb. base
100 lbs. to 300 lbs. in one order	35½c.	" " "
Less than 100 lbs. in one order	37c.	" " "

PRICES FOR SEAMLESS BRASS AND COPPER TUBING.

From 1¼ to 3½ O. D. Nos. 4 to 13 Stubs' Gauge, — per lb.
Seamless Copper Tubing, — per lb.

For other sizes see Manufacturers' List.

Due to fluctuations of the metal market we are unable to quote these prices.

PRICES FOR SEAMLESS BRASS TUBING Iron Pipe Sizes.

Iron pipe sizes with price per pound.

⅛ ¼ ⅜ ½ ¾ 1 1¼ 1½ 2 2½ 3 3½ 4 4½ 5 6

Due to fluctuations of the metal market we are unable to quote these prices.

PRICE LIST OF IRON LINED TUBING—NOT POLISHED.

	Per 100 feet Brass.	Bronze.
⅜ inch		
½ inch		
⅝ inch		
¾ inch		
⅞ inch		
1 inch		
1⅛ inch		
1¼ inch		
1½ inch		
1¾ inch		
2 inch		

Due to fluctuations of the metal market we are unable to quote these prices.

PRICE FOR TOBIN BRONZE AND MUNTZ METAL.

Tobin Bronze Red	39c.	net base
Muntz or Yellow Metal Sheathing (14" x 48")	35c.	" "
Muntz or Yellow Metal Rectangular sheets other than Sheathing	38c.	" "
Muntz or Yellow Metal Rod	36½c.	" "

Above are for 100 lbs. or more in one order.

PLATERS' METALS.

Platers' bar in the rough, 50c. net.

German silver platers' bars dependent on the percentage of nickel, quantity and general character of the order.

Platers' metal, so called, is very thin metal not made by the larger mills and for which prices are quoted on application to the manufacturer.

PRICES FOR SHEET BLOCK TIN AND BRITANNIA METAL.

Sheet Block Tin—18" wide or less. No. 26 B. & S. Gauge or thicker. 100 lbs. or more 5c. over Pig Tin. 50 to 100 lbs. 6c. over, 25 to 50 lbs. 8c. over, less than 25 lbs. 10c. over.

No. 1 Britannia—18" wide or less. No. 26 B. & S. Gauge or thicker, 100 lbs. or more 7c. over Pig Tin. 50 to 100 lbs. 8c. over, 25 to 50 lbs. 15c. over, less than 25 lbs. 9c. over.

Above prices f. o. b. mill.

Prices on wider or thinner metal on request.

PRICE SHEET FOR SHEET ALUMINUM—B. & S. Gauge.

Base price, 60c.

Gauge.	Width. Inches.	1 ton.	50 to 2,000 lbs.	Less than 50 lbs.
20 and heavier	3-30			
	3-30			
21 to 24 inclusive	30-48			
	48-60			
25 to 26	3-30			
	30-48			
27	3-30			
	30-48			
28	3-30			
	30-48			
29	3-30			
	30-48			
30	3-30			

We are unable to quote these prices, but they can be had upon application to manufacturers and dealers.

The above prices refer to lengths between 2 and 8 feet. Prices furnished by the manufacturers for wider and narrower sheet. No charge for boxing. F. O. B. Mill.

PRICE LIST SEAMLESS ALUMINUM TUBING.

STUBS' GAUGE THE STANDARD. SIZES CARRIED IN STOCK.

Outside Diameters.

Stubs' Gauge.	Inches.	¼ in.	5-16 in.	⅜ in.	½ in.	⅝ in.	¾ in.	⅞ in.	1 in.	1¼ in.	1½ in.	1¾ in.	2 in.	2½ ins.	3 ins.	3½ ins.	4 ins.	4½ ins.
11.	.120.																	
12.	.109.																	
14.	.083.																	
16.	.065.																	
18.	.049.																	
20.	.035.																	
21.	.032.																	
22.	.028.																	
24.	.022.																	

We are unable to quote these prices, but they can be had on application to manufacturers and dealers.

Prices are for ten or more pounds at one time. For prices on sizes not carried in stock send for Manufacturers' List.

PRICE LIST FOR ALUMINUM ROD AND WIRE.

We are unable to quote these prices.

BASE PRICE GRADE "B" GERMAN SILVER SHEET METAL.

Quality.	Net per lb.	Quality.	Net per lb.
5%	41c.	16%	45c.
8%	42½c.	18%	45½c.
10%	43c.	20%	48c.
12%	44c.	25%	57c.
15%	44½c.	30%	63c.

GERMAN SILVER WIRE.

Quality.	Net per lb.	Quality.	Net per lb.
5%	44c.	15%	50¾c.
8%	46c.	16%	51¼c.
10%	47½c.	18%	53¼c.
12%	49¼c.	30%	68½c.

The above Base Prices are subject to additions for extras as per lists printed in Brass Manufacturers' Price List and from such extras 50% discount will be allowed. The above base prices and discounts are named only to wholesale buyers who purchase in good quantities. Prices on small lots are considerably higher.

PRICES OF SHEET SILVER.

Rolled sterling silver .925 fine is sold according to gauge quantity and market conditions. No fixed quotations can be given, as prices range from 1c. below to 4c. above the price of bullion.

Rolled silver anodes .999 fine are quoted at 2¼c. to 3½c. above the price of bullion.